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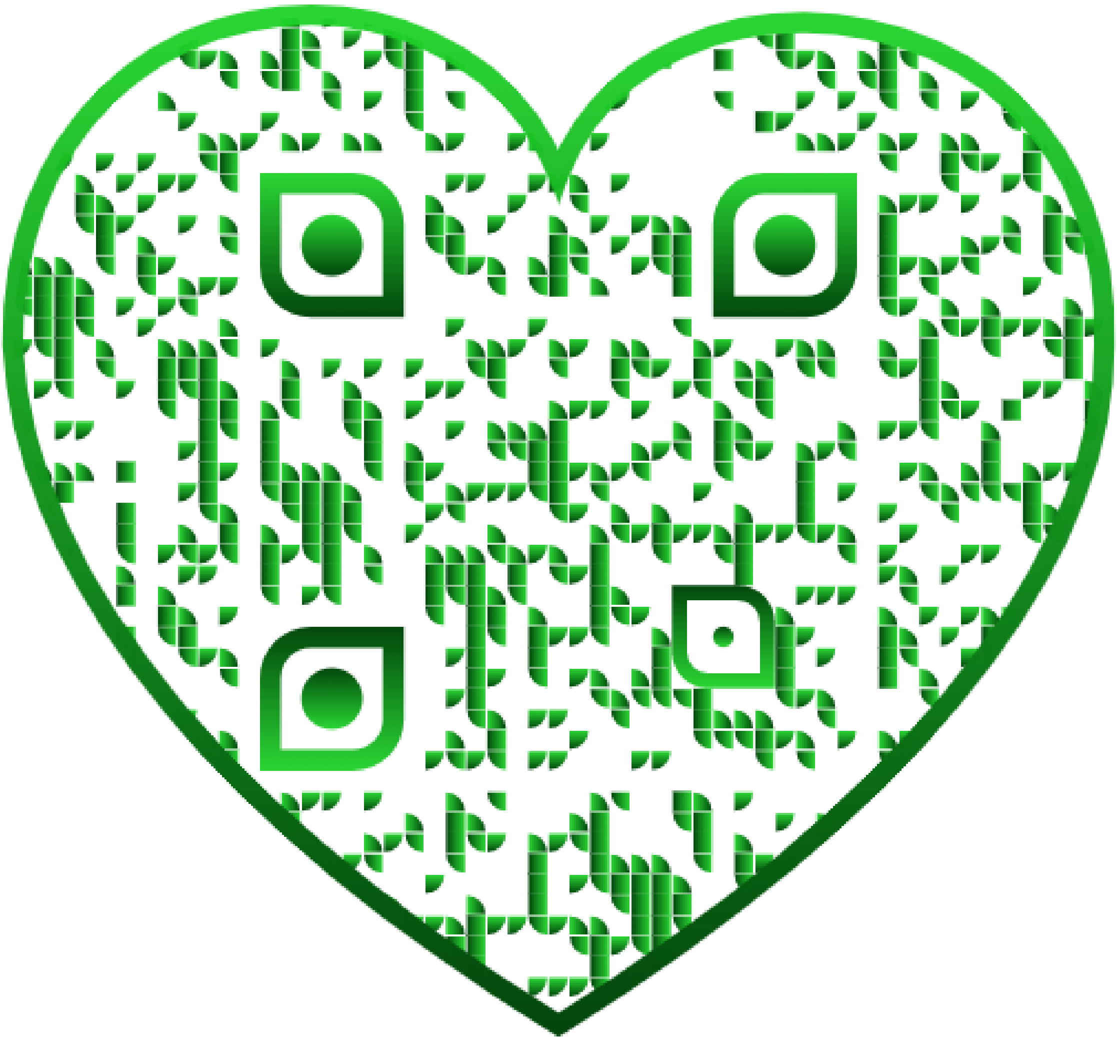

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Comment

Modernising the Pakistan Air Force for war

During July, I had permission to visit the Pakistan Air Force to be briefed on the recent shooting down of four Indian Air Force (IAF) Rafales in the long-running dispute along the border of Kashmir. When the PAF announced its claims on May 7, I was surprised and wanted to understand how they had done it.

I've been a regular visitor to the PAF since 2001, but my last time was five years ago in 2020. A new commander, Air Chief Marshal Zaher Ahmed Baber Sidhu, had since taken over in March 2021 and had been quietly transforming the PAF, veering away from it being platform-centric to multi-domain. By setting up space, cyber and electronic warfare commands, as well as building a ground-based air defence network and UAV force, he could have all the information fused into mobile C2 centres and the PAF Operations Centre, where ACM Sidhu and his team were provided with the desired situational awareness.

I was allowed to visit the new command centre to see how this worked and how, without the satellite imagery or any other proof other than social media, the PAF could prove to have downed the IAF Rafales. After all, these were state-of-the-art European fighters equipped with the Thales Spectra electronic warfare system. Over the course of my visit, I began to understand how they had achieved the seemingly impossible, which is covered in *Understanding the Rafale kills* on pages 43-58.

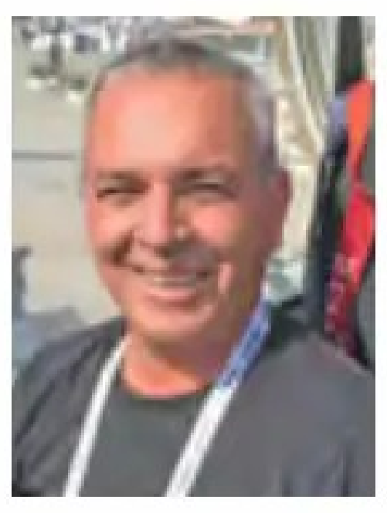
A four-ship of Pakistan Air Force J-10Cs equipped with 16 long-range PL-15E and eight PL-10 within-visual-range air-to-air missiles *Alan Warnes*

One of the first actions of ACM Sidhu as PAF commander was to order 20 multi-role Chengdu J-10Cs, to match with the very long-range Chinese PL-15Es and short-range PL-10s missiles the PAF had ordered. With these and the new multi-domain system working alongside them, the pilots did what was expected of them. From my experiences of working with the PAF over the past 24 years, I know how hard they train. During my frequent visits to the Indian Air Force between 1997-2007, before command stopped me because of my PAF links, tactical training never seemed to be as important and still today you get the impression the IAF believe that all the modern equipment they have purchased can work together without the necessary training. They should have learned their lessons from the 2019 Op Swift Retort, just like the PAF did, but instead carried on relying on their new 'gucci' gear.

Perhaps now the IAF might consider that tactical training and the modernisation of its operational doctrine might just be the way forward.

Enjoy the feature.

Alan Warnes
Editor at Large, *AirForces Monthly*



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***COVER –* A fully armed Pakistan Air Force J-10C comes in for the kill, just as it might have done on May 7, when a number of 'Vigorous Dragons' shot down Indian Air Force Rafales** Alan Warnes

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Eleven helicopters took part in this year's Galileo SAR Meet at Kbely Air Base in the Czech Republic, with the German H145 teasm emerged as overall winners. Alan Warnes reports

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The Danish Air Force recently led a multinational beach landing exercise on Romo Island off the coast of Denmark. Willem Sander Termorshuizen and Tieme Festner (DAPPA) were there

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A preview of what's on the modern military aviation agenda in the November 2025 issue

Gamechanging weapon for Ukraine

RAACM
COASPIRE

The RAACM is one of the ALCMs developed as part of the ERAM programme. Reportedly it could be integrated on any aircraft capable of carrying a GBU-38 joint direct attack munition (JDAM) guided bomb, which suggests that all UkrAF fighters and strike aircraft would be eligible *CoAspire*

ON AUGUST 28, the US Defence Security Cooperation Agency (DSCA) and Ukrainian officials confirmed that the US State Department had approved the sale of up to 3,350 extended range attack munition (ERAM) missiles. They come equipped with a combined inertial/GPS jam-resistant navigation module, plus all the related equipment which both sides hope will make a difference in the conflict with Russia. The estimated cost of this acquisition, funded by Denmark, Netherlands, Norway and the US is $825 million.

The ERAM programme was launched by the USAF Life Cycle Management Centre (AFLCMC) in July 2024, aimed at developing an affordable, mass-produced long-range strike weapon for Ukraine – a low-cost, air-launched cruise missile (ALCM). The original technical requirements, first published in January 2024, called for an ALCM in the 500lb class with a range of at least 250nm, a flight speed of at least Mach 0.6 and precision of 10 metres (ie, circular error probable with 50% probability) that could counter GPS jamming. Another vital requirement was achieving a production of more than 1,000 units per year within 24 months, ensuring that Ukraine had a sustainable long-range strike capability.

Details on the programme are scarce, but the two contractors mentioned in DSCA's announcement were CoAspire and Zone 5 Technologies. While the CoAspire-developed missile is undoubtedly the Rapidly Adaptable Affordable Cruise Missile (RAACM) produced using 3D printing technology, the model that was developed by Zone 5 Technologies remains unidentified. It also remains to be seen whether this ALCM can be deployed by all Ukrainian Air Force (UkrAF) aircraft capable of carrying Western guided weapons or its use would be limited to the F-16. Nevertheless, such a weapon that could be launched in mass numbers will certainly have a considerable effect on the situation in Ukraine.

Meanwhile, on August 24, Ukraine's Defence Minister Denys Shmyhal thanked the Swedish government for transferring two Saab 340B-based S 100D Argus (ASC 890) airborne early warning and control (AEW&C) aircraft fitted with the PS-890 Erieye radar. This came a day after his Swedish counterpart Pål Jonson visited Kyiv. No further details were released, but since their transfer was originally announced in May 2024 (see *Ukraine to gain Swedish AEW&C aircraft*, July 2024, p7) one of the aircraft has been used for pre-delivery training of UkrAF personnel, while the other continued to perform regular surveillance missions (for more see *No changes on the front line*, pages 14-16).

Vladimir Trendafilovski

One of the two Swedish ASC 890 AEW&C slated for transfer to Ukraine, seen here at Keflavik, Iceland in July 2024 *NATO Allied Air Command.*

Tragedy in Poland

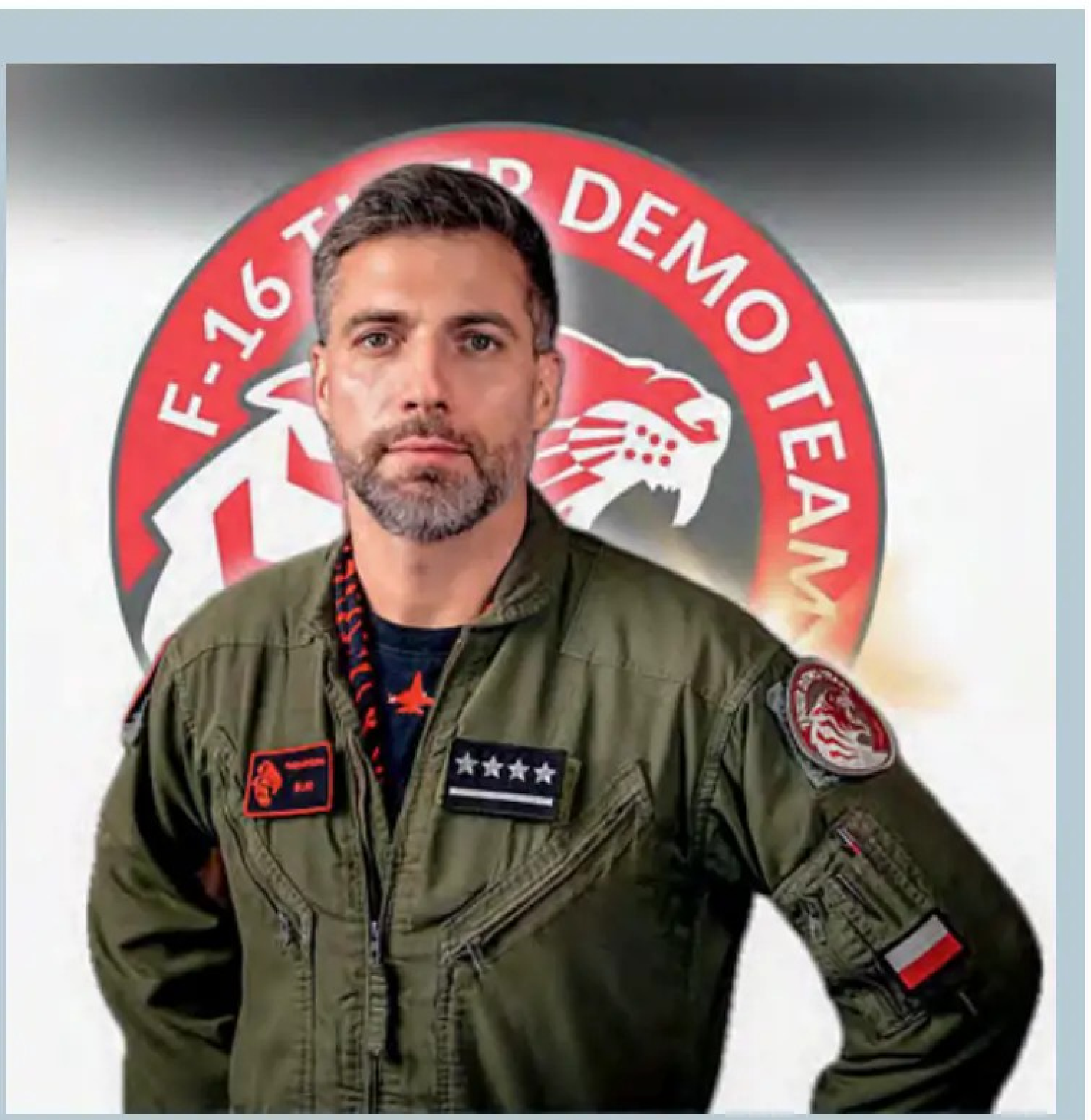
TRAGEDY STRUCK the Polish Air Force (PAF) airshow at Radom-Sadkow Air Base (AB) on the evening of August 28, when the PAF F-16 display pilot Major Maciej 'SLAB' Krakowian was killed. While coming out of a loop in full afterburner during a rehearsal display, his F-16 Block 52+ slammed into the ground and was immediately engulfed in a huge fireball. Footage from various angles showed that no ejection took place. The airshow, which was set to take place on August 30-31, was cancelled.

Polish Defence minister Wladyslaw Kosiniak-Kamysz wrote: "A Polish Army pilot died in the crash of an F-16 aircraft – an officer who always served his country with dedication and great courage. I pay tribute to his memory." Poland's Armed Forces Operational Command added: "Though words fall short of capturing the weight of this blow, we wish to express our deepest solidarity in mourning. Farewell, master. Your flights will remain in our memory as a symbol of excellence, passion and dedication."

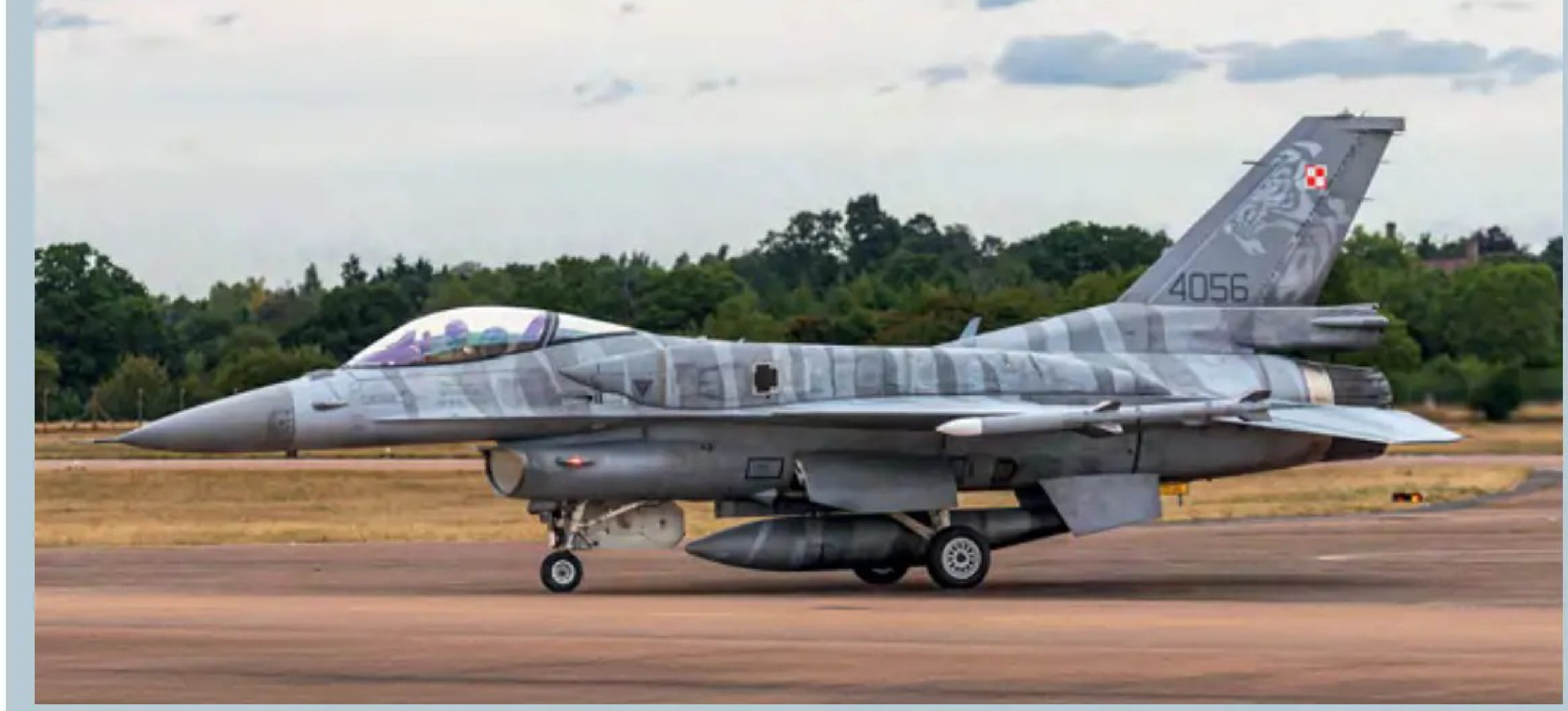
Maj Krakowian was the leader of the Polish F-16 Tiger Demo Team, which itself is part of the 6 Eskadra Lotnicza (6th Tactical Squadron) based at 31st Tactical Air Base, Poznań-Krzesiny. Last month at RIAT 2025, he and the Polish Tiger Demo team were honoured with the As The Crow Flies trophy for the best overall flying demonstration.

Krakowian was a graduate of the Polish Air Force University in Dęblin, before being selected to train on the F-16 in the US and qualified as an instructor. At the time of his death he had amassed more than 1200 flight hours on the F-16.

This crash happened just two weeks after Poland signed a $3.8 billion deal to upgrade its entire fleet of 48 F-16C/D block 52+ fighters to F-16V Block 72 Viper standard (see page 12).



Major Maciej 'SLAB' Krakowian *Polish Air Force*



The aircraft lost was 4056, which is adorned with the tiger stripes and logo of the Tiger Demo Team. It is seen here arriving at RAF Fairford to take part in RIAT 2025, where the team would win the As The Crow Flies trophy *Ben Stanley Hall*

Pakistan Army receives Z-10s

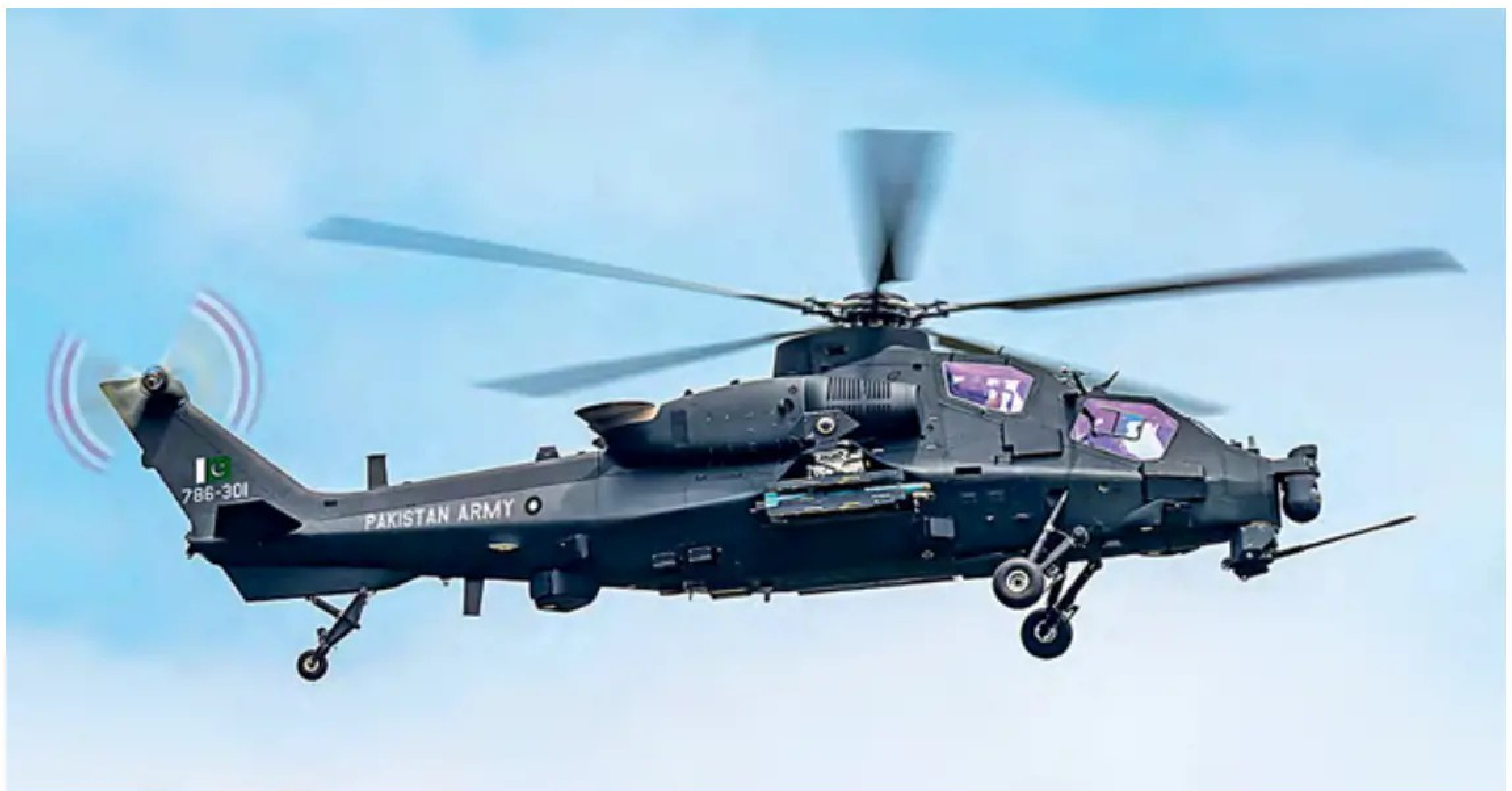
IN LATE July, it was confirmed that Pakistan Army Aviation had received a substantial boost with the delivery of an initial batch of Changhe Z-10ME attack helicopters. This milestone marked a dramatic shift in Pakistan's defense procurement strategy, further aligning it with Chinese systems and addressing a critical capability gap left by the stalled acquisition of US AH-1Z Super Cobras and the blocked sale of T800 engines for Turkey's T129s. Ultimately, the Pakistan Army decided to procure the significantly upgraded Z-10ME, despite initially declining the original Z-10A. The Z-10s will undoubtedly replace the PAA's ageing AH-1 Cobra fleet, based at Multan.

This advanced variant incorporates enhanced electronics, such as a new identification friend or foe (IFF) system, an optional mast-mounted millimetre-wave (MMW) search radar and laser DIRCM turrets positioned atop the stub wings. Additionally, it has multiple rectangular laser/UV missile approach warning system (MAWS), electronic support measures (ESM) and electronic countermeasure (ECM) antennas, as well as pulse-Doppler radar MAWS antennas along the lower fuselage. Protection is further improved by ceramic armour plating, while a larger ammunition magazine in the nose and a new JPX-10D cannon increase combat effectiveness. Redesigned engine inlets featuring particle separators, together with the more powerful WZ-9C turboshaft engines, round out the upgrades.

Notably, the Z-10ME variant can deploy a new weapons suite, including CM-502KG anti-tank guided missiles (ATGMs) and PL-90A air-to-air missiles (AAMs).

According to the limited imagery available, the helicopters delivered to the Pakistani army feature a distinctive dark green camouflage pattern.

Andreas Rupprecht



The clearest image yet released of a Pakistan Army Corps of Aviation Z-10ME, reportedly during trials in China. While some claim the image is photoshopped, no evidence of manipulation has been found. *Via Chinese internet*

Op Chessman concludes

THE RAF concluded its latest air policing mission in early August with the end of Operation Chessman.

Since March, RAF Lossiemouth-based II(AC) Squadron and 140 Expeditionary Air Wing (EAW) have conducted the Enhanced Air Policing (eAP) mission from the 22nd Tactical Air Base, Malbork. This was the first time a UK Air Policing Detachment had conducted eAP from Poland having previously undertaken a number of detachments in Estonia, Lithuania, Iceland and Romania.

A Typhoon FGR4 in one of the Rapid Erect Shelters provided by RAF Wittering-based 5001 Squadron *MOD/Crown Copyright*

During the four months of Op Chessman, the detachment's six Typhoon FGR4s flew 460 hours and were scrambled on more than 20 occasions. The joint operation with the Swedish Air Force, which deployed six JAS-39 Gripens, was the first overseas operational deployment since the nation became a full NATO member in March 2024.

At the end of the detachment, Wing Commander Jacob, Commander 140 EAW, said: "It has been an honour to lead such a dedicated and professional team during Operation Chessman. Our presence alongside NATO's newest member Sweden has facilitated their integration into the Air Policing mission and reinforced our shared commitment to deterrence, readiness and interoperability."

He added: "Op Chessman has been the busiest and most demanding Air Policing mission that I've experienced. Co-ordinating flight operations and delivering actionable intelligence in a fast-paced environment required a high level of precision and teamwork. Operating alongside our NATO partners has been a force multiplier, enabling seamless integration, shared awareness and enhanced mission effectiveness. The support and professionalism across the alliance have been key to our success."

Operations from Malbork were enhanced by the provision of a number of rapid erect shelters constructed by RAF Wittering based 5001 Squadron. Part of 42 Expeditionary Support Wing, the squadron enables ground engineering functions in support of deployed air operations, which can also include portable aircraft arrester gear.

Ex Hornet's Sting

FURTHER TRIALS launching first-person-view (FPV) drones from a Chinook helicopter while airborne have been conducted by the RAF.

Exercise Hornet's Sting saw student drone operators and their instructor dispatch FPV quadcopters from a Chinook HC6 flown by a crew from 18(B) Squadron, RAF Odiham, Hampshire. Once released, the operators flew the drone towards a moving target, in this instance a Land Rover Defender vehicle. Control of the drone was also undertaken by personnel on the roof of a nearby building.

A Joint Aviation Command trial, Hornet's Sting took place on July 31 at Copehill Down, a purpose-built village used to train for operations in an urban environment on the Salisbury Plain Training Area, Wiltshire.

The trial follows the previous Hornet's Nest undertaken at Boscombe Down in March and conducted by a Combined Test Team comprising personnel from 744 Naval Air Squadron, the Rotary Wing Test and Evaluation Squadron, and 22 Squadron, the tri-service rotary operational evaluation unit. The MOD was keen to point out the somewhat niche claim that the trial represented the first time a UK military-registered uncrewed air system had been launched from a military-registered crewed aircraft.

A quadcopter is launched from the ramp of a Chinook on Exercise Hornet's Sting. *MOD/Crown Copyright*

Hornet's Nest used 12cm and 25cm Viking Arms FPV drones. In April, the Ministry of Defence ordered 180 units (including 20cm drones) for the British Army. Procured in just 19 days, the drones will provide realistic combat training and be equipped with payloads simulating anti-tank, anti-personnel and anti-structure munitions.

It is unclear whether the trials will extend to other platforms, but is considered likely.

An Army spokesperson said: "FPV drones equipped with thermal imaging can provide a significant advantage in night-time operations, reducing the risks associated with crewed missions in low-visibility conditions. This technology is seen as a crucial element in maintaining a modern and adaptable fighting force."

MOD seeks multi-engine pilot training provider

THE UK Ministry of Defence (MOD) has issued a preliminary market engagement notice inviting Civilian Aviation Authority Approved Training Organisations (ATO) to train up to 24 multi-engine fixed-wing pilots from January 2026 to December 2027. The £4.8m contract has the potential for a two-year extension.

The training will use two syllabi due to differing input standards and onward training routes. The first, Multi-Engine Crossovers (MEXO), is for up to 12 trainees crossing over to multi-engine aircraft from other types. Students will have previously completed Elementary Flying Training, Fast-Jet Lead-In and Basic Fast-Jet Training with associated ground schools to qualify.

Alternatively, the trainees may be previously qualified RAF fast-jet or rotary-wing pilots who have been awarded RAF Wings and completed at least one front-line tour and who have accumulated approximately 1,000+ total flying hours.

The second group, again of up to a dozen trainees, will be ab initio students who will have only completed Elementary Flying Training and associated ground school. These students will be trained on both single and multi-engine aircraft prior to undertaking additional training with the military. The single engine element is to broadly mirror the Private Pilot Licence syllabus, which will allow them to gain Pilot in Command experience and focus on instrument flying skillsets.

This will be followed by a multi-engine syllabus, which should build on instrument flying techniques as well as teaching asymmetric flying skills. The MOD is not looking for the award of any licence on completion of this course.

The provision of external training will relieve pressure on the RAF's multi-engine training operation at RAF College Cranwell in Lincolnshire, where 45 Squadron operates five Phenom T1s to train students to meet frontline demand from Atlas, Envoy, Rivet Joint, Shadow, Poseidon and Voyager fleets.

The UK MOD is looking to relieve pressure on 45 Squadron which uses five Phenom T1s to train multi-engine pilots. *Dylan Eklund*

AW139s to replace Dauphin in FOST role

The new HeliOperations AW139s will be added to the UK military register *Kevin Wills*

A £41 MILLION, five-year contract has been awarded by Defence Equipment & Support (DE&S), the UK Ministry of Defence's procurement arm, to Dorset-based HeliOperations. The Fleet Helicopter Support Unit (FHSU) contract will see the company support training for UK and NATO global maritime operations by providing Navy Command with a pair of AW139 helicopters along with comprehensive technical support, maintenance, pilots and crew.

Operating from the former RNAS Portland (HMS Osprey) on the Isle of Portland on the south coast of England, initial operating capability is expected in spring 2026. The contract will enable the transfer of personnel and equipment to warships and vessels at sea, providing maritime rotary wing support primarily to Fleet Operational Standards and Training (FOST), but also additional aviation tasks as required.

FOST provides operational sea training for all Royal Navy surface and sub-surface vessels together with the fleet of Royal Fleet Auxiliary support ships. This is undertaken by a team of experts who operate from Royal Navy bases in Devon, Plymouth and the Clyde in Scotland.

The two AW139s replace a AS365 N2 Dauphin II (ZJ165). In common with the helicopter they replace, the new aircraft will be added to the UK military register in due course. The increased size and performance of the AW139 will be welcome, the modest range of the smaller and less powerful Dauphin has limited the type's utility, particularly when carrying a full complement of passengers wearing heavy immersion suits.

The contract, which will create 15 new jobs and sustain 80 existing roles, has the potential to be extended until 2036 at a value of up to £68 million.

Mark Langrill, director of air rotary and uncrewed air systems at DE&S, said: "We are delighted to award this contract to HeliOperations. The agreement will provide the Royal Navy with modern, reliable helicopter support, whilst supporting skilled jobs and economic growth in South-West England, reinforcing our commitment to working with small, high-end British enterprises that deliver for our Armed Forces."

HeliOperations has experienced rapid expansion in recent times and has now established a strong presence across three UK-based locations, beginning with Portland and subsequently opening facilities in Somerton in Somerset and Culdrose, Cornwall.

In November 2024, the company secured a £141m contract to provide comprehensive training for German Navy helicopter pilots. The seven-year contract, awarded by the German defence ministry, uses AW139s to train students destined for the NH90 Sea Lion and Sea Tiger helicopters. Flying training includes theoretical instruction, advanced simulator sessions and practical live flight training by day and night.

Steve Gladston, HeliOperations CEO, said: "The FHSU contract is an important milestone for HeliOperations as part of our continuing development and growth. It provides the opportunity for further expansion of our fleet of AW139 helicopters, development of our infrastructure and greater opportunities for our staff whilst providing the Ministry of Defence with an efficient and effective service for the delivery of personnel and materiel to the Fleet."

USAF fighter pilots to train in Italy

Riccardo Niccoli reports on one of the most important contracts for Italy's International Flight Training School

ON AUGUST 22, the United States Air Force, signed up to the Italian Air Force's International Flight Training School (IFTS) based at Decimomannu, Sardinia. The contract is known as the Concept of Operations (CONOPS) for Flight Training of the USAF Military Personnel in Italy. The Memorandum of Understanding was signed by the Italian Air Force Chief of Staff, Gen. SA Antonio Conserva, and Lt Gen Brian S Robinson, Commander of the Air Education & Training Command (ATEC) of the USAF.

This is a historic step for the US Air Force, as never before has it trained pilots outside of the USA. It is being taken due to the delay of the Boeing T-7A Red Hawk's introduction into service, while the T-38C fleet becomes old and outdated.

The selection of the IFTS came after a series of visits of US delegations to the 61° Stormo and to the IFTS, and after the presence at the 212° Gruppo in the past of at least one Instructor Pilot of the USAF in exchange.

Officials were apparently impressed by the performance of the T-346A as well as by the Integrated Training System which is at the top of its sector.

The two air forces worked together on the development of a training program for the US students on the basis of the Multiphase Jet Training Integrated Syllabus, which is a nine-month full course staged by the IFTS to ensure students are ready to be assigned to an OCU (Operational Conversion Unit) with a solid experience and knowledge of fighter operations, both in air-to-air and air-to-ground environments. Pilots fly the T-346A in the final missions of the course in swing-role mode, including in-flight refuelling and the use of precision-guided munitions, datalink and interoperability with command-and-control aircraft.

The Italian Air Force Chief of Staff, Gen SA Antonio Conserva (seated) and some of his staff at the signing of the agreement with the *USAF's AETC Aeronautica Militare/Troupe Azzurra*

Back in 2018, the Italian Air Force announced the future establishment with Leonardo of a new and state-of-the-art structure destined to perform the Lead-In to Fighter Training (LIFT) activity, which is the final part of the training for the pilots destined to join fighter fleets. The idea was to exploit at maximum the capabilities of the Integrated Training System (ITS) studied for Phase 4 of the syllabus, consisting in the T-346 aircraft and simulators, including the Embedded Tactical Training Simulation (ETTS) and the Live Virtual Constructive (LVC) capability, as well as the solid professional tradition and reputation of the Italian Air Force in the training sector.

The IFTS, which is the international name for the 212° Gruppo of the 61° Stormo, began operating in June 2021, and was conceived to train the Italian Air Force pilots, but above all to host foreign operators. To this end, a completely new complex was built on the base at Decimomannu, designed to accommodate the aircraft and the maintenance support (provided by Leonardo), the facility housing all the offices, classrooms and simulators, and the buildings necessary to create a luxury campus. The first international students to train with the M-346 ITS came from Kuwait, and started their first course in 2018, while the first IFTS course

M-346
IFTS
61-32

Part of the IFTS/212° Gruppo flight line at Decimomannu. Aircraft '61-32' is one of the six M-346B of the Qatar Emiri Air Force
Riccardo Niccoli

A view of one of the Ground Based Training System's Full Motion Simulators *Aeronautica Militare/Troupe Azzurra*

IFTS
GROUND BASED TRAINING SYSTEM

The brand new building of the Ground Based Training System of the IFTS, part of the new campus at Decimomannu *Riccardo Niccoli*

started in 2021 with Qatar students. Work on the Decimomannu air base started in 2019 and the training was moved from Lecce-Galatina to Decimomannu in June 2022, while the whole complex was completed in 2023.

Many important air forces have already sent students to Decimomannu or signed a memorandum for future training, including Austria, Canada Germany, Hungary, Japan, Netherlands, Qatar, Saudi Arabia, Singapore, Spain, Sweden, United Kingdom, and now USA. Other air forces have shown interest in this school, but the number of slots available has been limited, as the Italian Air Force wants to offer the best quality of training.

Currently, the IFTS/212° Gruppo operates a fleet of 18 T-346A, plus four T-346B owned by Leonardo. In 2024, the Italian MoD signed a contract with Leonardo for another batch of this aircraft; 15 are destined to re-equip the Italian national aerobatic team 'Frecce Tricolori', and five will be assigned to the IFTS, which then will boast a fleet of 27 aircraft.

The IFTS is also hosting M-346Bs owned by the Qatar Emiri Air Force and used exclusively to train its pilots. At present, the school is aiming to produce about 80 pilots per year. To accomplish this target, there will be about 40 instructor pilots from participating air forces, plus Leonardo's civilian contracted pilots, all with a military career with the Italian or foreign allied air forces. There are instructor pilots serving the IFTS from Austria, Canada, Singapore, Sweden (one is under training), and USA (one will be assigned in the future).

The first course with ten USAF pilots was scheduled to start on September 8 and should be completed by June 2026, leading the students to the USAF military wings.

Three T-346A from the 212° Gruppo in formation during a training mission *Riccardo Niccoli*

Polish F-16s to get upgrade

ACCORDING TO Poland's Ministry of National Defence, the country's fleet of F-16s is to be modernised to the F-16V standard. The $3.8 billion contract between the US and Poland will see 48 F-16C/D block 52+ fighters will be upgraded to the F-16V Viper configuration, known as the Viper mid-life upgrade (MLU).

The modernisation will include equipping the jets with a Northrop Grumman AN/APG-83 SABR AESA radar, to increase the range, tracking and mapping capabilities. Pilots will benefit from upgraded cockpit digital displays to increase situational awareness. Advanced electronic warfare systems will be improved by adding the AN/ALQ-254 Viper shield and various structural modifications to improve the overall lifespan of the airframe. The MLU will also render the F-16s compatible with new precision weapons, such as the AGM-158 JASSM cruise missile and the AIM-9X Sidewinder air-to-air missile.

The Minister of National Defence said: "The current capabilities of the F-16 in the C/D version are good, but not adequate to counter present threats after these 20 years. We must enhance our reconnaissance capabilities, communication and integration with the F-35, Abrams tanks and Apache helicopters, as well as our capabilities across every domain. This modernisation will allow us to move on from the C/D Block 52 version to V Block 72 – the same level Slovakia is buying as its most advanced aircraft."

Israeli retires Atalef fleet

ON SEPTEMBER 2, the Israeli Air and Space Force retired its final three AS565MA Atalef naval helicopters. These three aircraft remaining from the original order of five were based at Ramat David Air Base and fell under the command of 193 Squadron 'Defenders of the West'. Despite being an air force unit, 193 Squadron formed a crucial partnership with the Navy for almost three decades. It was tasked with anti-submarine warfare, maritime search and rescue and aerial guidance for naval ships.

The Atalefs will be replaced by eight SH-60Fs that were ordered in 2015 from the US Department of Defence (DoD) via the Excess Defense Articles (EDA) Program. As the SH-60 was partially selected due to its commonality with the already operated S-70 Yanshuf, it is expected that 193 Squadron will relocate to Palmachim, where 123 Squadron 'The Desert Birds' and 124 Squadron 'The Rolling Sword' are located, as well as the Israeli Navy Heron Shovals.

Israel's three remaining AS565 Atalefs – 882, 889 and 895 – performed one final formation flight before their retirement on September 2 *Israeli Air and Space Force*

Embraer delivers first Portuguese A-29Ns

The first three A-29N Super Tucanos were welcomed to Portugal with a traditional water-cannon salute at OGMA's facilities at Alverca

BRAZILIAN MANUFACTURER Embraer recently delivered the first three A-29N Super Tucanos for the Portuguese Air Force to MRO specialist OGMA's facilities at Alverca, on the outskirts of Lisbon. There the necessary changes will be made and the required equipment installed to bring the aircraft to NATO standard. The three aircraft, wearing Brazilian civil registrations PT-CXA, PT-CVN and PT-CYV, departed Embrear's facility at Gavião Peixoto in Brazil on August 25 and arrived at Alverca on August 31.

The delivery, which happened less than nine months after the contract was signed on December 16, 2024, will provide a much-needed boost for Portuguese training needs. The contract for the 12 aircraft was priced at €200M and is the first order of the Super Tucano by a European nation for a type that is operated by 22 air forces worldwide.

Once delivered, the aircraft will be operated by Esquadra 103 'Caracóis', which previously operated the Dassault/Dornier Alpha Jet between 1993 and 2018.

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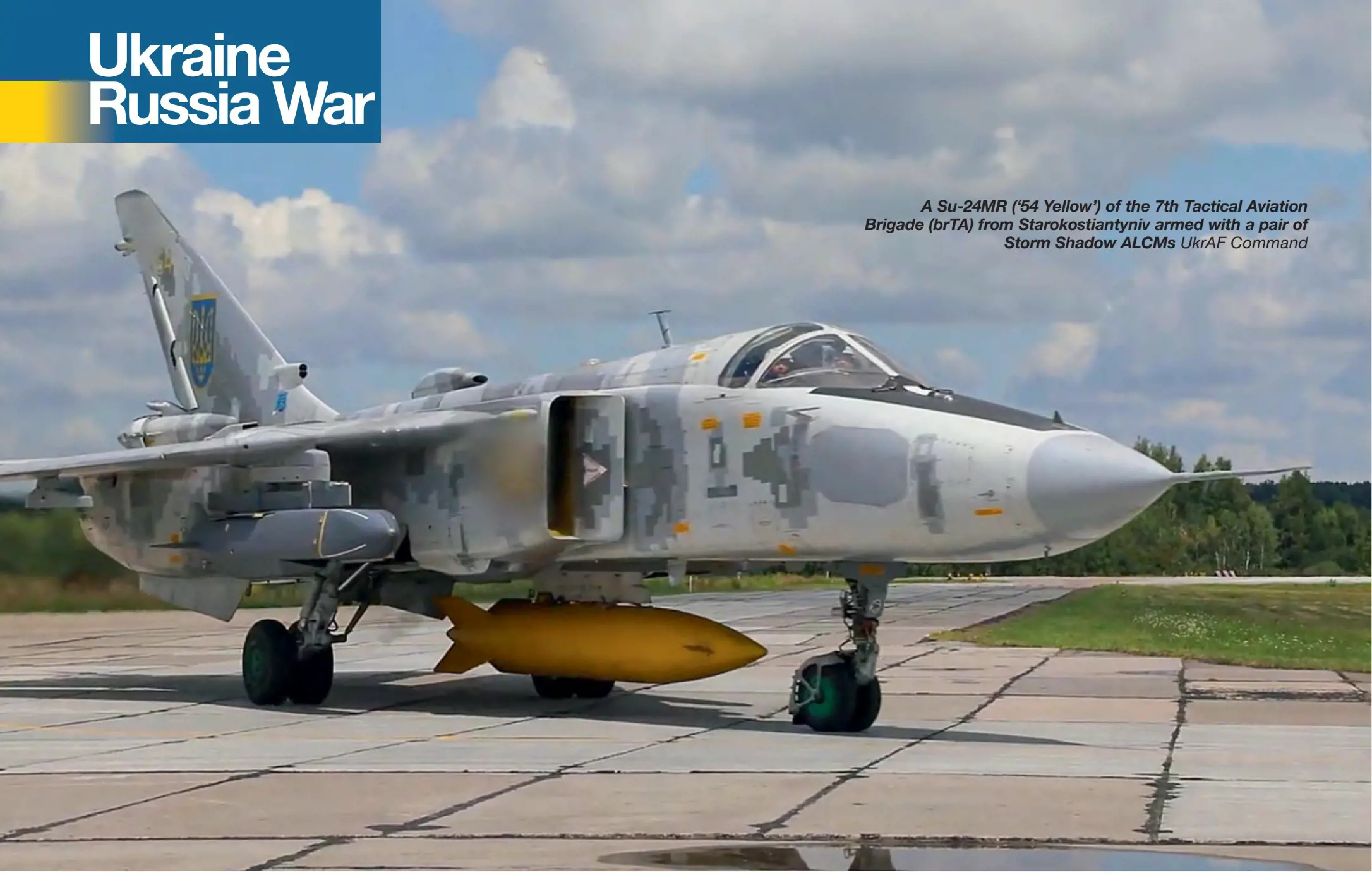


A Su-24MR ('54 Yellow') of the 7th Tactical Aviation Brigade (brTA) from Starokostiantyniv armed with a pair of Storm Shadow ALCMs *UkrAF Command*

No changes on the front line

Vladimir Trendafilovski

DESPITE ONGOING multinational efforts to bring peace to Ukraine, including the US-Russia summit held in Anchorage, Alaska, on August 15, the conflict continued unabated throughout August. Unhindered by significant losses in both personnel and materiel, Russia continued its relentless offensive along almost the entire front line, further expanding its territorial gains.

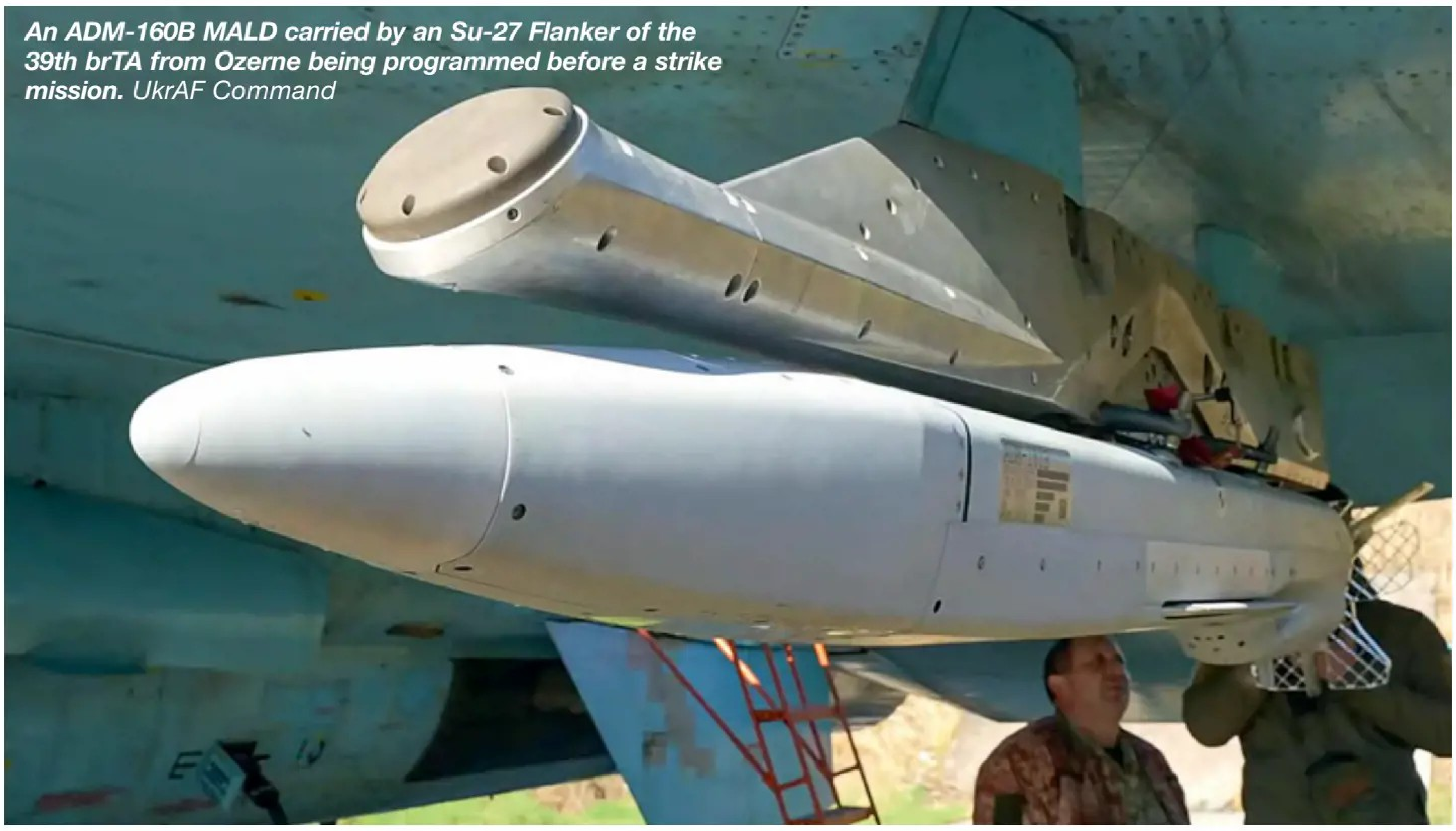
Judging by the latest number of the infamous 'KABs' (iron bombs turned into guided glide bombs by adding the so-called UMPK wing kit), the strike element of the Russian Air Force (RuAF) is back on its feet again, dropping an average of 168 KABs a day. Although somewhat reduced due to the amount spent in July, kamikaze drones combined with missiles continue to terrorise Ukraine's civilians.

On the other hand, Ukraine is continuing its efforts to stem the Russian drone threat using all available means, while also upgrading its deep strike capabilities with new long-range missiles and drones in an attempt to disrupt Russia's fuel and weapons production and supply chain.

Russian KAB threat on the rise again

In August, a total of 5,210 KABs were dropped (820 of these in Russia's Kursk Oblast – where Ukraine still holds a token portion of territory, adjacent to the Sumy Oblast). This was a significant increase in comparison with the previous two months (see Russia increases drone attacks, September 2025, p16-19), exceeding the results from May (5,017 KABs). Still, despite that, it remains considerably below the monthly record established in April (6,526 KABs). Given that a daily average of 150-170 KABs is considered the optimum for RuAF's strike fleet of Su-34 *Fullbacks* and Su-24 *Fencers* (see A war gone off course, August 2024, p32- 39), it's unlikely the numbers will rise again.

The KABs remain a grave threat



An ADM-160B MALD carried by an Su-27 Flanker of the 39th brTA from Ozerne being programmed before a strike mission. *UkrAF Command*

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A volley of four RuAF KABs launched against the bridge linking Quarantine Island with the rest of Kherson in early August. Note that only two of these struck on/near their target – the remaining two fell short *Russian Internet Resources*

to Ukraine's civilians living in areas near or on the front line. The city of Kherson, the capital of the Kherson Oblast, located on the right bank of the Dnieper River (the current demarcation line), is an excellent example. On August 2, the RuAF began daily KAB attacks against the only bridge connecting Quarantine Island with the rest of the city. After a week of bombardment, the bridge remained standing, albeit heavily damaged. Still, the civilians had to be evacuated to prevent casualties from the straying KABs and avoid being trapped on the island.

Drones continue to terrorise civilians

As for kamikaze drones (Shahed-136 clones and derivatives, plus decoy drones), in August, Russia launched a total of 4,132 drones (of these, 3,445 or 83% were downed or crashed). The number was drastically reduced (66%) compared with the figures for July, when the current monthly record of 6,297 drones was established. This is no doubt the result of Russia having to replenish its stockpile in the first half of August, when rarely more than 100 drones a day were launched against Ukraine.

A Shahed-136 (Geran-2) kamikaze drone is seen through night-vision goggles moments before being engaged by a Ukrainian AA helicopter *Ukrainian Internet Resources*

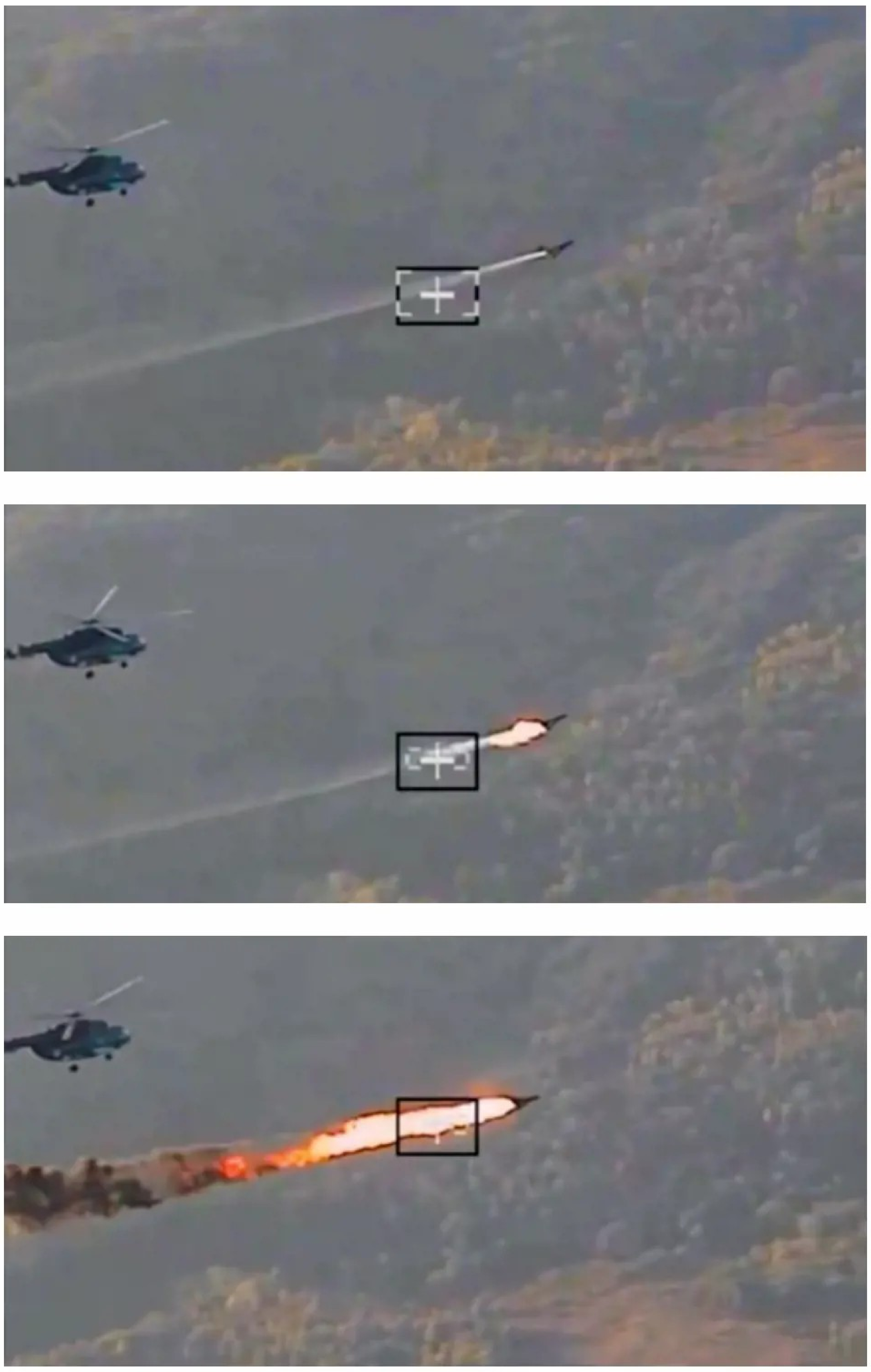
In late August, the familiar combined mass drone/missile attacks recommenced, again aimed against Ukraine's capital, Kyiv. These included the Kh-101 (AS-23 *Kodiak*) air-launched cruise missiles (ALCMs) and Kinzhal (AS-24 *Killjoy*) hypersonic air-launched ballistic missiles deployed from RuAF aircraft, plus other ground and sea-launched missiles.

The deadliest attack was on the night of August 28, when 598 drones and 31 missiles were launched against Ukraine in total. Of these, 563 and 26, respectively, crashed or were downed by ground-based air defence (GBAD) systems and fighters of the Ukrainian Air Force (UkrAF). Remaining drones and missiles struck predominantly residential areas in Kyiv – killing at least 25 people (including four children) and wounding 63 others (including 11 children).

The latest Russian jet-powered drone – the 'Geran-3', a Shahed-136 variant with what appears to be a Chinese-made jet engine – was also noted in August, with UkrAF reporting that it had downed a dozen of them. Last, but not least, in August, Russia set a new monthly record for first-person view (FPV) kamikaze drones, with a total of 150,126, or a daily average of 4,843.

Ukraine carries on

In addition to intercepting Russian drones and missiles with all its available fighters, UkrAF continues conducting regular attacks against high-value targets using Western guided glide bombs and ALCMs. It is worth mentioning that, in addition to the strike component, which delivers its weapons on target, all ground attack missions typically include a defensive Suppression and Destruction of Enemy Air Defences (SEAD/DEAD) component – fighters carrying the AGM-88 High-Speed Anti-Radiation Missile (HARM). As soon as a threat interfering with the primary mission is detected, they would fire HARMs at it – generally forcing a Russian GBAD system to shut down its radar and evacuate its firing position to avoid destruction, ultimately enabling the strike element to perform its mission successfully and return home. In case of missions involving the Storm Shadow/SCALP-EG ALCMs, the SEAD/DEAD component also includes fighters armed with the ADM-160B Miniature Air-Launched Decoy (MALD). These decoys are launched before the real ALCMs, forcing Russian GBAD not only to expend surface-to-air missiles (SAMs) against them, but also enabling the aircraft equipped with HARMs to engage the systems attacking the decoys.

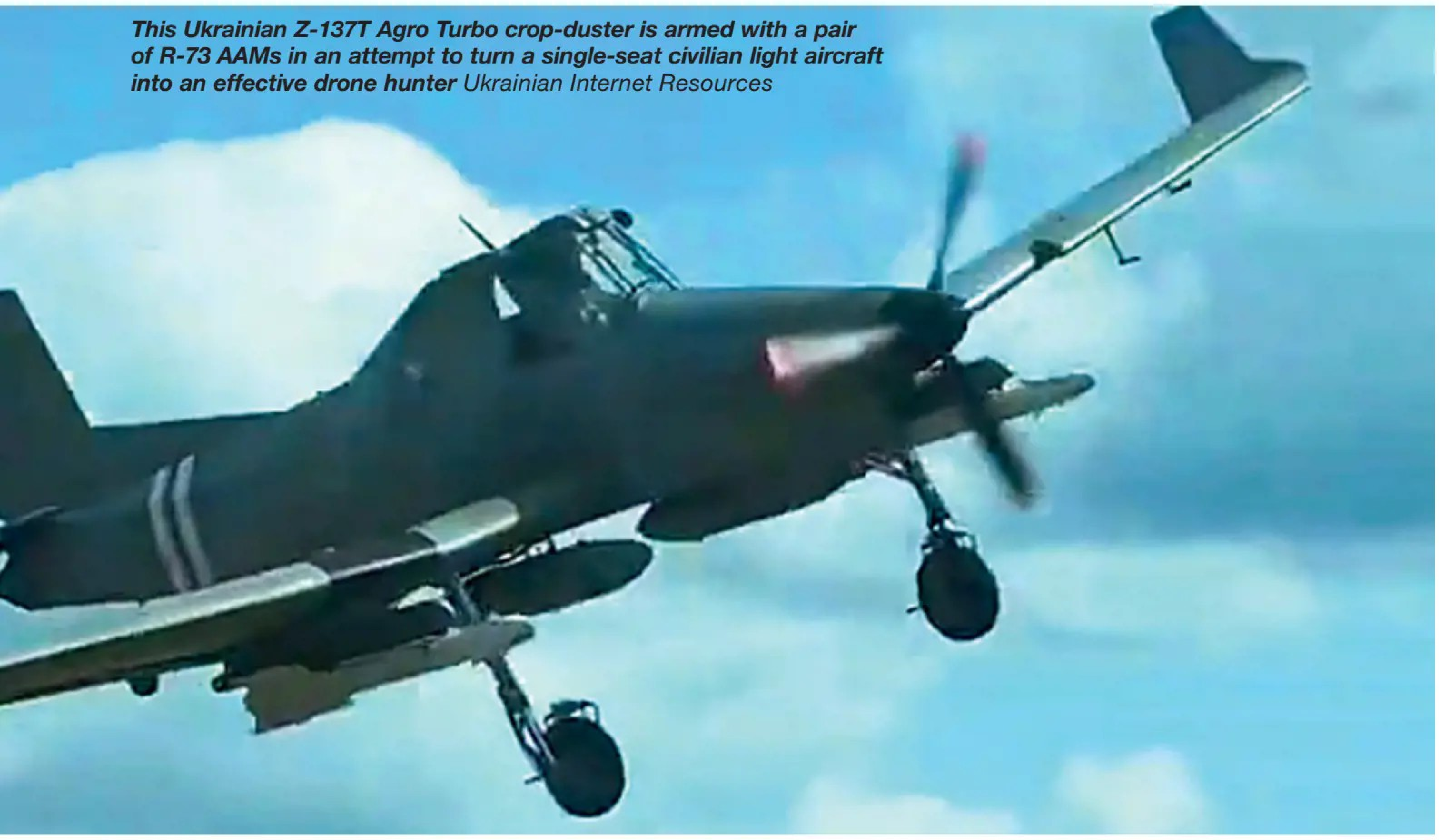


This sequence shows a Ukrainian AA Mi-8MT Hip-H transport helicopter shooting down a Shahed-136 (Geran-2) kamikaze drone *Ukrainian Internet Resources*

As a final note, the latest reports suggest that a transfer of two S 100D Argus/ASC 890 airborne early warning and control (AEW&C) aircraft from Sweden is imminent, along with a plan to provide UkrAF with substantial quantities of US-built low-cost ALCMs (Gamechanging Weapon for Ukraine p.6). If we also factor in Ukraine's latest indigenous long-range ground-launched cruise missiles, such as the Long Neptune and FP-5 Flamingo (both publicly unveiled in August), this could prove to be a winning combination that could tip the scales in favour of Ukraine, enabling this protracted conflict to come to an end finally.

Drone hunters

Since the war began, Ukraine's civilian light aviation aircraft – including various aerobatic and



This Ukrainian Z-137T Agro Turbo crop-duster is armed with a pair of R-73 AAMs in an attempt to turn a single-seat civilian light aircraft into an effective drone hunter *Ukrainian Internet Resources*

agricultural aircraft, as well as utility or training helicopters, along with their pilots – have joined Ukraine's war efforts, usually operating in conjunction with local units. As the war progressed, they were predominantly incorporated into the Army Aviation (AA), a branch of Ground Forces that serves the bulk of Ukraine's military helicopters.

For example, the 11th Independent AA Brigade (obrAA) – initially based in Kherson, now operating from various field strips on the southern sector of the front – has a light aviation squadron. The 11th obrAA accounts for 10-12% of Russian drones intercepted each day over Ukraine and, in addition to its helicopters, the light aviation squadron also has a significant share in these results.

The squadron has approximately 20 pilots and air gunners and among its other aircraft, it has a Yak-52 two-seat aerobatic trainer that is regularly engaged in drone-hunting missions. One of the more seasoned crews has 300 combat flights under its belt, downing 60 Russian drones so far, including both surveillance and kamikaze drones. These crews operate much the same as the Yak-52 that flew over Odesa in 2024 (see Civilian Yak-52 downs Russian UAV in Ukraine, July 2024, p7), engaging their targets using various automatic weapons or shotguns. Nonetheless, their tasks are fraught with dangers – friendly fire, interception gone wrong (collision with a target or its debris), and a Russian Iskander-M (SS-26 *Stone*) ground-launched ballistic missile.

The latter is quite a real threat: the Odesa-based Yak-52 mentioned above was destroyed by one in 2024, and being a thorn in Russia's side, these aircraft are constantly on the move to avoid its fate. As a stark reminder of the seriousness of the situation, on July 18, the squadron was attacked by a single Iskander-M while operating from an undisclosed airstrip in the Dnipropetrovsk Oblast. The squadron commander, Col Kostiantyn 'Kamikaze' Oborin, was killed, along with another squadron member.

This is not the only example of a civilian aircraft adapted into a drone hunter that appeared in public in August – a turboprop-powered Zlin Z-137 Agro Turbo single-seat crop duster also appeared, armed with two R-73 (AA-11 *Archer*) short-range air-to-air missiles (AAMs), but its parent unit is unknown.

Eyes in the sky

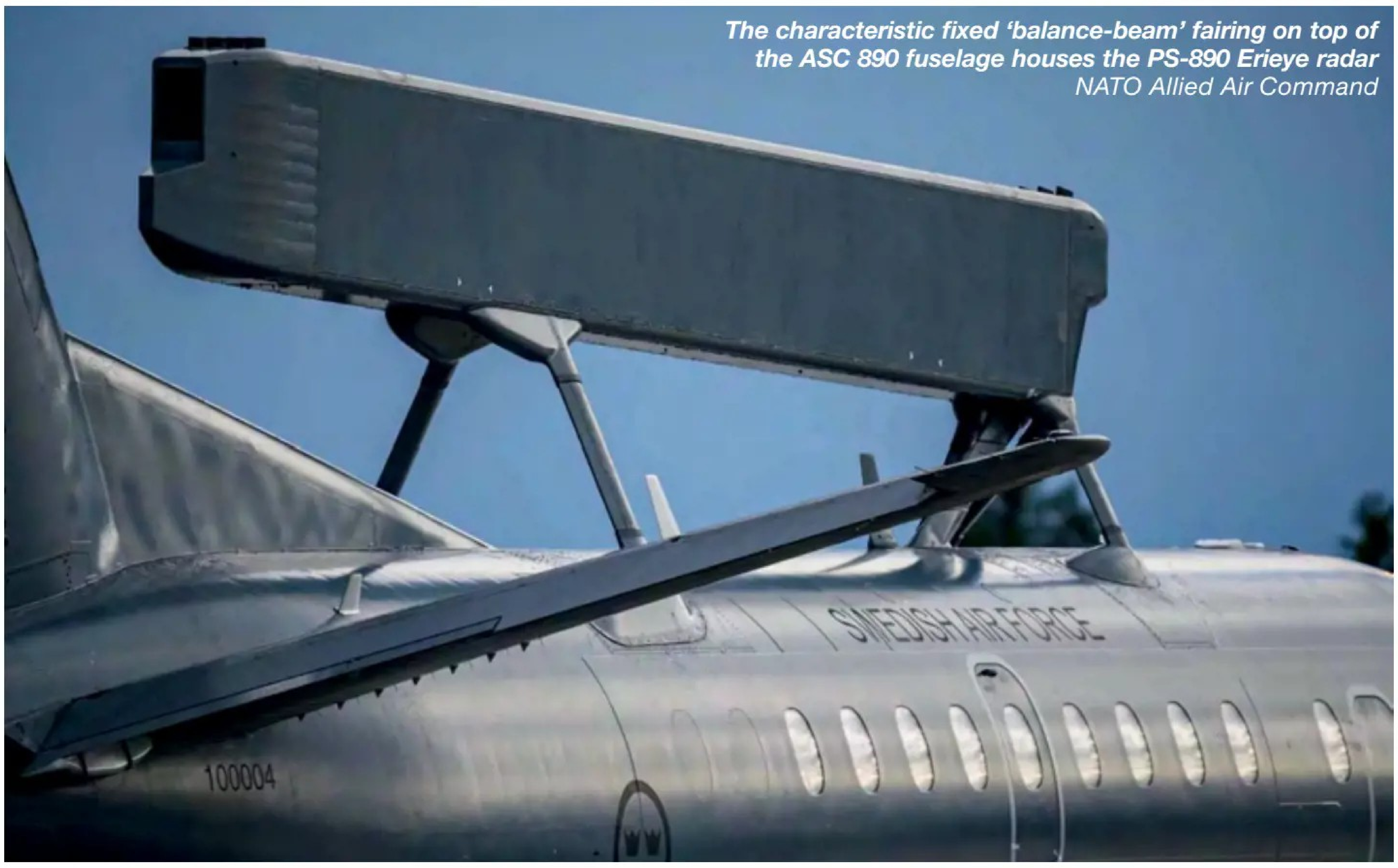
The S 100D Argus AEW&C aircraft from Sweden will significantly enhance UkrAF's capability to detect low-flying aerial targets at longer distances – including drones and missiles – directing its fighters and other assets to intercept/destroy these in real-time. So far, the UkrAF has relied solely on its ground radar network for the task, having minimal capability to detect low-flying targets far from the front line.

However, they will also be a prime target for RuAF's fighters and interceptors with long-range AAMs like the R-37M (AA-13 *Axehead*) – forcing them to operate at a safe distance from the front line.

In March, Russia resumed using its A-50 *Mainstay* AEW&C fleet in operations against Ukraine, after a year-long absence following a loss of two A-50Us in 2024 ('37 Red/RF-93966' and '42 Red/RF-50610' –see Ukraine downs 13 RuAF jets in a month, April 2024, p10).

These are instrumental in detecting low-flying UkrAF aircraft and enable RuAF's GBAD systems and fighters to intercept them. Reports suggest that these appear intermittently – RuAF being very reluctant to lose any more of these vital and expensive assets.

Despite Russian sources claiming that the RuAF has eight A-50Us, it is believed that the actual number is seven – the five surviving original pre-war A-50Us, plus two A-50s converted into A-50Us, delivered in 2023 and 2024, presumed to be aircraft '50 Red/RF-50601' and '51 Red/RF-50606'. **afm**



The characteristic fixed 'balance-beam' fairing on top of the ASC 890 fuselage houses the PS-890 Erieye radar *NATO Allied Air Command*

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Second B-21 to fly imminently

As the B-21 Raider flight test programme progresses, performance data continues to align with digital model predictions *Northrop Grumman*

THE HEAD of the USAF Global Strike Command has said that a second B-21 Raider will soon take to the skies as the test programme for the sixth-generation bomber is accelerated. The move comes as flight testing for the prototype of the new stealth bomber is continuing at pace at Edwards Air Force Base in California.

Gen Thomas A Bussiere said: "We should see the second developmental test bird fly shortly." The USAF also confirmed that at least two more will be flying in 2026, and that these test aircraft will be combat-capable if necessary.

Built as production aircraft, the early B-21s represent a significant step in the development of the USAF's next-generation long-range strike capability. The programme recently received a boost from law-makers, who passed a reconciliation bill that includes $4.5bn to increase B-21 production.

According to Gen Bussiere, driving the increase in production capacity is "a great realisation of the value and prominence of long-range strike and the ability to hold at risk anything on the planet at a time and place of our choosing".

Skyraider II testing continues at Eglin

An OA-1K Skyraider II lands on a dirt path at Eglin AFB, Florida, on July 10, 2025. It is undergoing developmental testing with the 96th Test Wing and the US Special Operations Command *USAF*

THE USAF Special Operations Command's newest aircraft, the OA-1K Skyraider II, is continuing developmental testing at Eglin Air Force Base, Florida, to ensure it can meet operational requirements.

The 96th Test Wing, in co-ordination with US Special Operations Command, is responsible for the developmental testing of the new aircraft. The test team goals are to evaluate the Skyraider II's military airworthiness and verify the accuracy of the manufacturer's performance data. The team will also evaluate how effective the aircraft is at its purposed special operations mission.

The OA-1K Skyraider II is a new cost-effective crewed aircraft intended to support geographically isolated special operations personnel in austere locations. It has adaptable capabilities for required mission sets such as close air support, precision strike or armed intelligence, surveillance and reconnaissance.

The Skyraider II features a tailwheel, which has not been seen in the Air Force for more than five decades. This distinguishable feature required test evaluators to devise a new methodology to verify its performance. Specifically, it requires extra pilot training with the Skyraider II's civilian variant, the AT-802, to learn to fly the tailwheel aircraft effectively.

Test wing pilots of various backgrounds who matched with the aircraft's mission sets answered the call to test the Skyraider II. So far, test aircrews have performed human factor, handling quality and austere landing missions, with sensor quality and weapons release missions planned for the future.

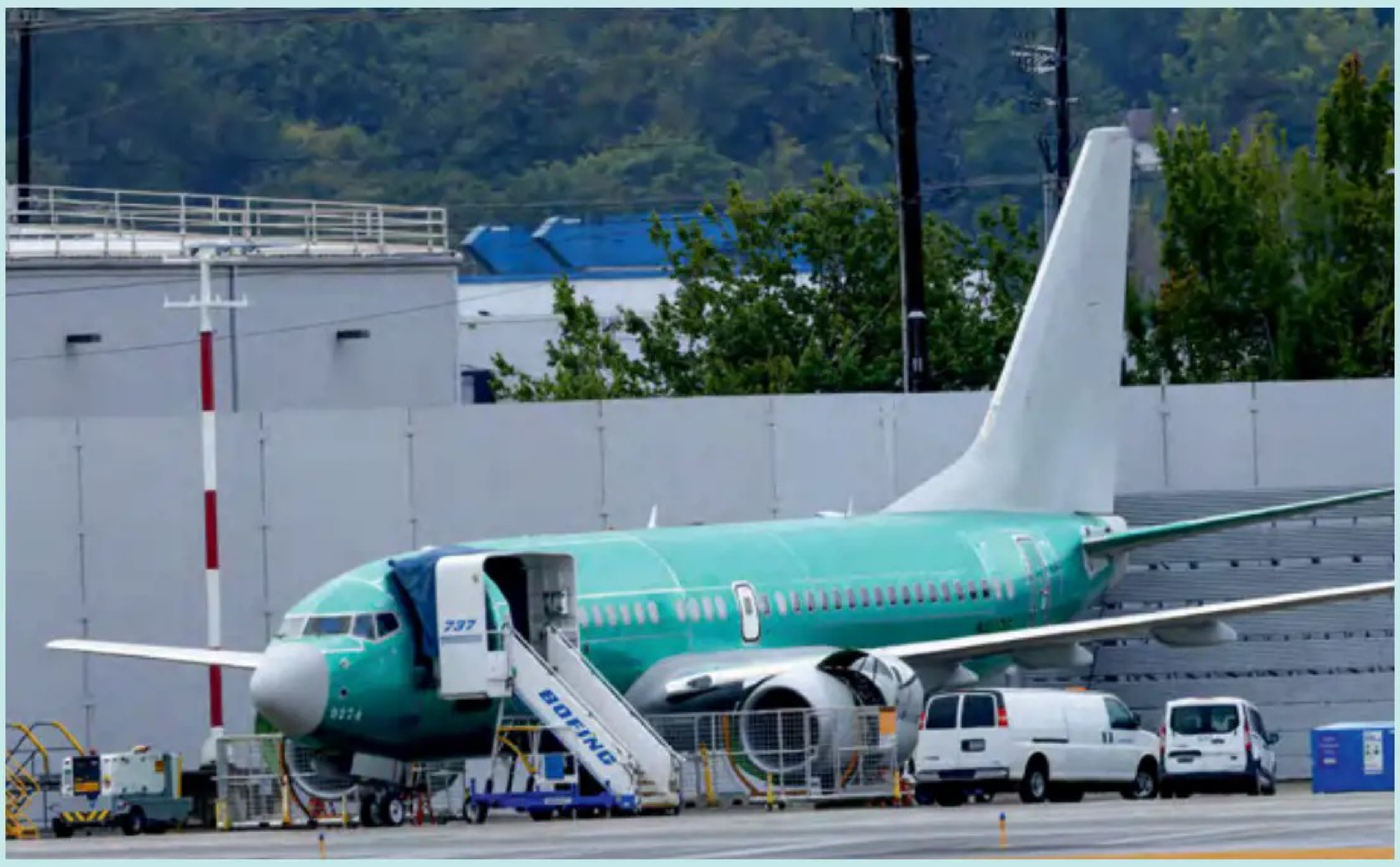
Maj Jacob Marsh, 96th OG chief of group training, said: "Flying the OA-1K has been a rewarding experience and certainly something that has required me to bring my skills to work every day. The fun of flying it is just a perk of the job." Maj Marsh explained that flying un-augmented UH-1Ns at the US Naval Test Pilot School gave him a unique appreciation for the co-ordination needed in the OA-1K. According to Marsh, there are many aviation commonalities between helicopters and airplanes when operating at similar airspeeds.

USAF Wedgetail breaks cover

THE FIRST US Air Force E-7 Wedgetail has been seen for the first time at Boeing Field, in Seattle, Washington State. N471DS was seen on August 6, 2025 and will become the first E7 for the USAF. Line number is 9274; construction number 68737.

A second E-7 was also seen at Boeing's plant.

John Spencer



Super Squadron Test enters Phase II in South Korea

PHASE II OF the USAF's Super Squadron Test has begun with the first F-16 Fighting Falcons relocating from Kunsan Air Base to Osan Air Base in South Korea. The Seventh Air Force, a numbered unit of the US Pacific Air Forces (PACAF), is reassigning more than 31 F-16s and 1,000 airmen over the next few months, in time for the start of Phase II in October 2025.

Senior Master Sgt Jason Thomas, flight chief of the 51st Maintenance Group Sortie Generation, said: "I hear a lot about concepts like multi-capable airmen or mission-ready airmen, but our airmen are truly making this a reality. It's truly impressive how they have been able to adjust."

The 51st Fighter Wing is based in Osan and will continue to maintain Osan Air Base's 'Fight Tonight' defensive posture with the Republic of Korea Air Force. Capt Bryce Hughes, 51st Maintenance Group Officer and Sortie Generation Flight Commander, said: "Osan is receiving additional F-16s as part of the USAF's Super Squadron Test Part II initiative, which is a force-optimisation designed to see if a larger, consolidated squadron can generate more combat power and operate more efficiently."

Col Ryan Ley, 51st Fighter Wing Commander, added: "The 51st Fighter Wing is leading the charge on the Super Squadron Test. I look forward to testing the limits of what we can do over the next year."

A USAF F-16 Fighting Falcon taxis along the flight line after landing at Osan Air Base, South Korea, July 28, 2025, as part of the USAF's Super Squadron Test Phase II *USAF/ Senior Airman Tallon Bratton*

Truman offloads ammo

An MH-60S Sea Hawk of Helicopter Sea Combat Squadron 11 transports ordnance from the flight deck of USS *Harry S Truman* ***(CVN 75) during an ammunition offload on August 4*** *US Navy/Mass Communication Specialist 2nd Class Logan Nystrand*

SAILORS FROM the weapons, air and deck departments of USS *Harry S Truman* (CVN 75), among others, worked alongside the 'Dragonslayers' of Helicopter Sea Combat Squadron (HSC) 11 to transfer 1,307 tons of conventional munitions to the Nimitz-class aircraft carrier USS *George H W Bush* (CVN 77) and the Lewis and Clark-class dry cargo ship USNS *Robert E Peary* (T-AKE 5) during vertical and connected replenishment operations on August 3-8.

Lt Cdr Jason O'Neal, *Truman*'s weapons officer, said: "Our weapons department sailors put in long, demanding hours to make this evolution a success, but they weren't alone. The bridge teams kept us steady, deck department ensured safe and efficient movements of cargo, air department kept the flight deck running smoothly and the 'Dragonslayers' of HSC-11 delivered every time. Many other departments worked behind the scenes to keep us safe, on time and mission-focused. This was a true whole-ship effort."

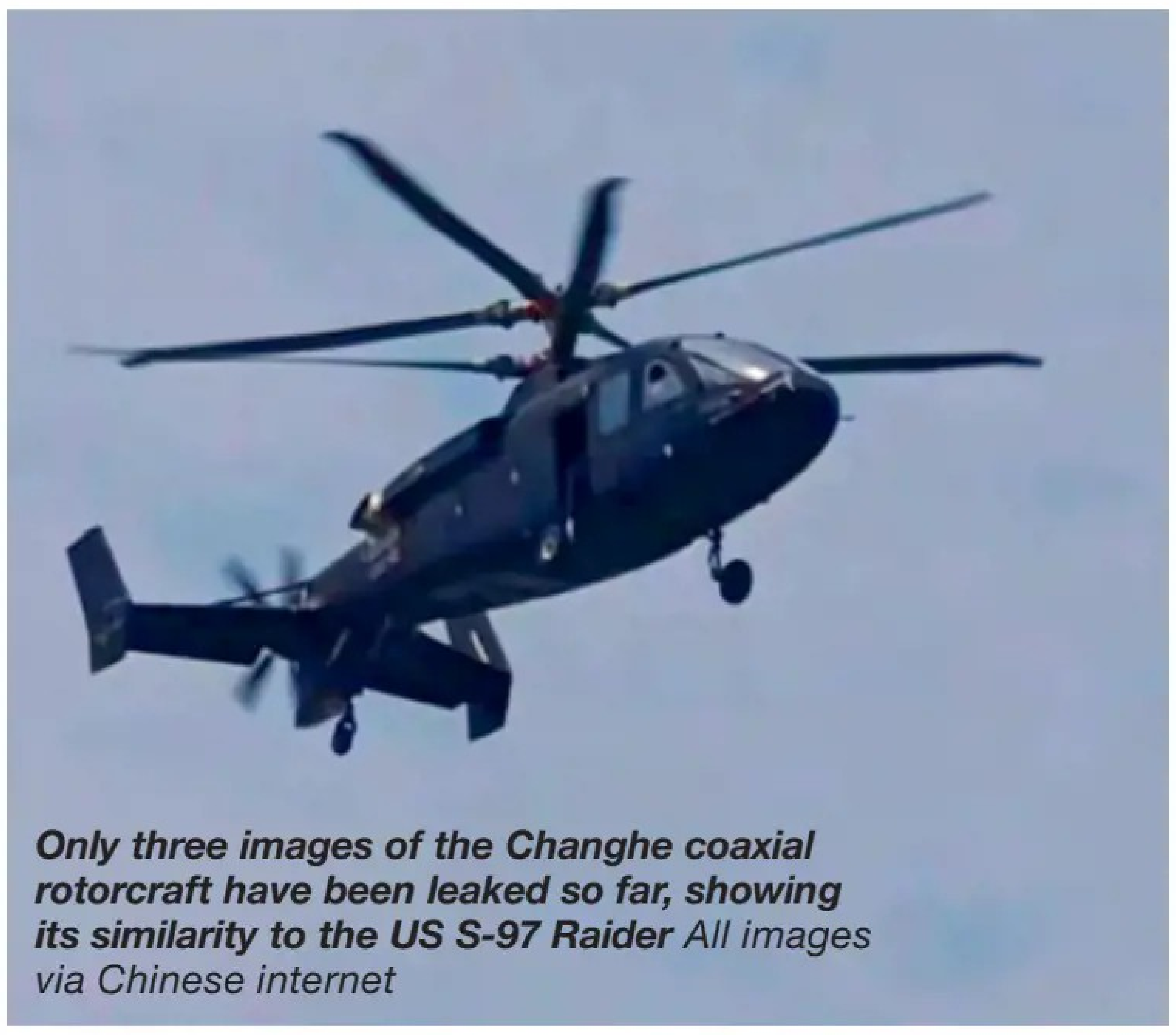
HSC-11 was one of nine embarked squadrons assigned to the *Harry S Truman* Carrier Strike Group's Carrier Air Wing (CVW) 1, which logged more than 25,000 flight hours during the 2024-2025 deployment to the Red Sea. *George H W Bush* is the tenth and final Nimitz-class carrier, while *Robert E Peary*, assigned to Military Sealift Command, has long supported *Harry S Truman* with agile logistics and strategic sealift around the world.

On the flight deck, weapons department sailors meticulously secured pallets of ammunition to helicopters, ensuring the continuous, safe movement of ordnance throughout each day of operations. Aviation ordnanceman airman Eduardo Manzanares, of Raleigh, North Carolina, said: "This was my first ammo offload, and it was a lot of work. What we do matters and I'm proud of our team for getting it done safely."

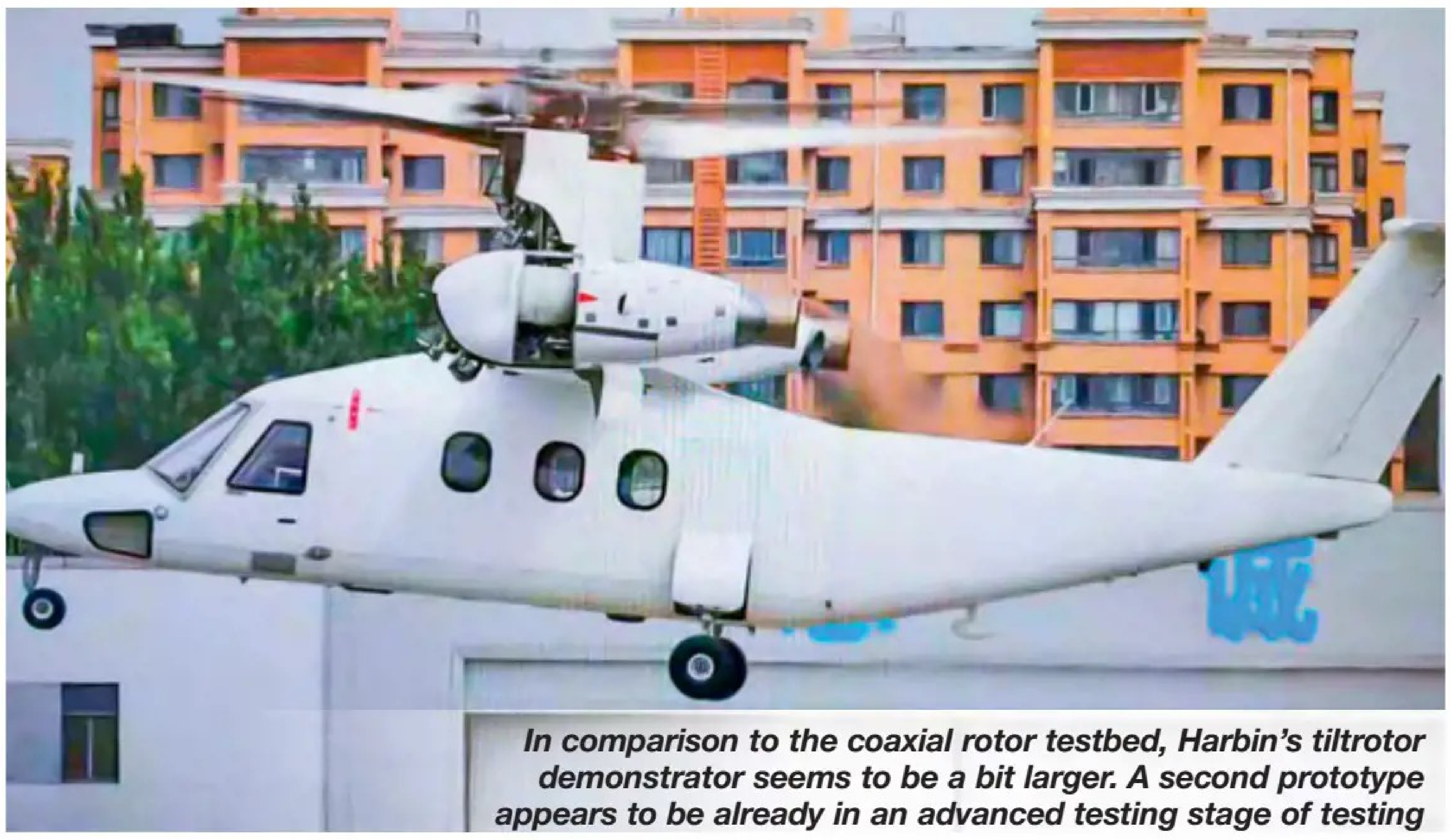
Ammunition offloads are standard following deployments and before maintenance periods. In 2024, *Harry S Truman* supported a multi-ship offload with USS *Dwight D Eisenhower* (CVN 69), USS *Gerald R Ford* (CVN 78) and USNS *William McLean* (T-AKE 12), completing more than 1,700 ordnance transfers.

by Andreas Rupprecht

Rotorcraft demonstrators break cover



Only three images of the Changhe coaxial rotorcraft have been leaked so far, showing its similarity to the US S-97 Raider *All images via Chinese internet*

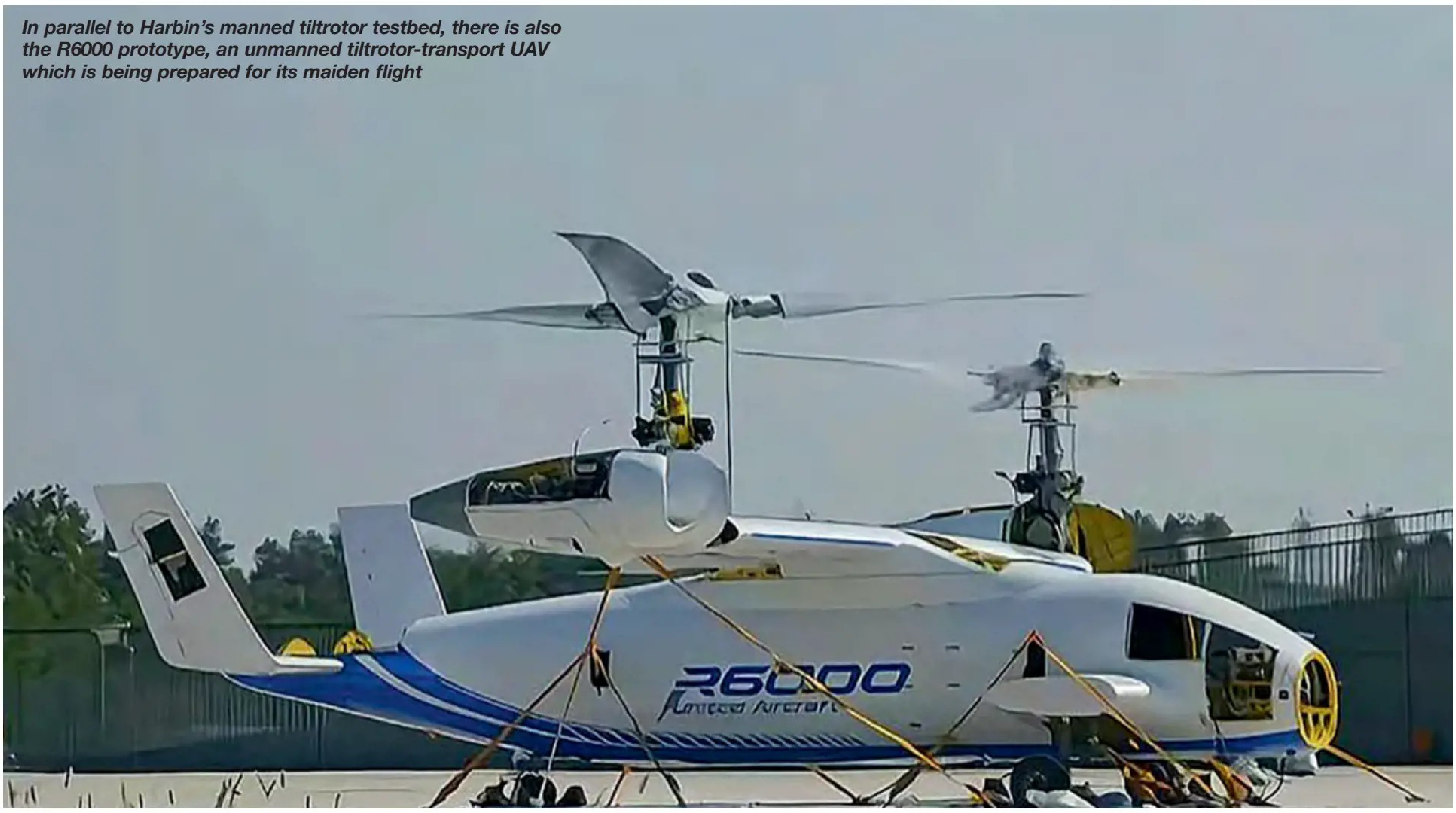


In comparison to the coaxial rotor testbed, Harbin's tiltrotor demonstrator seems to be a bit larger. A second prototype appears to be already in an advanced testing stage of testing

FOR SOME time it has been rumoured that Institute 602/Changhe was working on a high-speed helico.pter featuring a coaxial rotor combined with a pusher propeller comparable to the Sikorsky S-97 Raider. Surprisingly, a technology demonstrator was leaked in late August 2025. Based on the few images available, it looks to be smaller than the S-97, but still represents a major breakthrough in this field of technology. However, the role of the helicopter, which allegedly flew several months ago, is unclear. It could serve as the basis for a next-generation high-speed transport or an attack helicopter or possibly more related towards civil application.

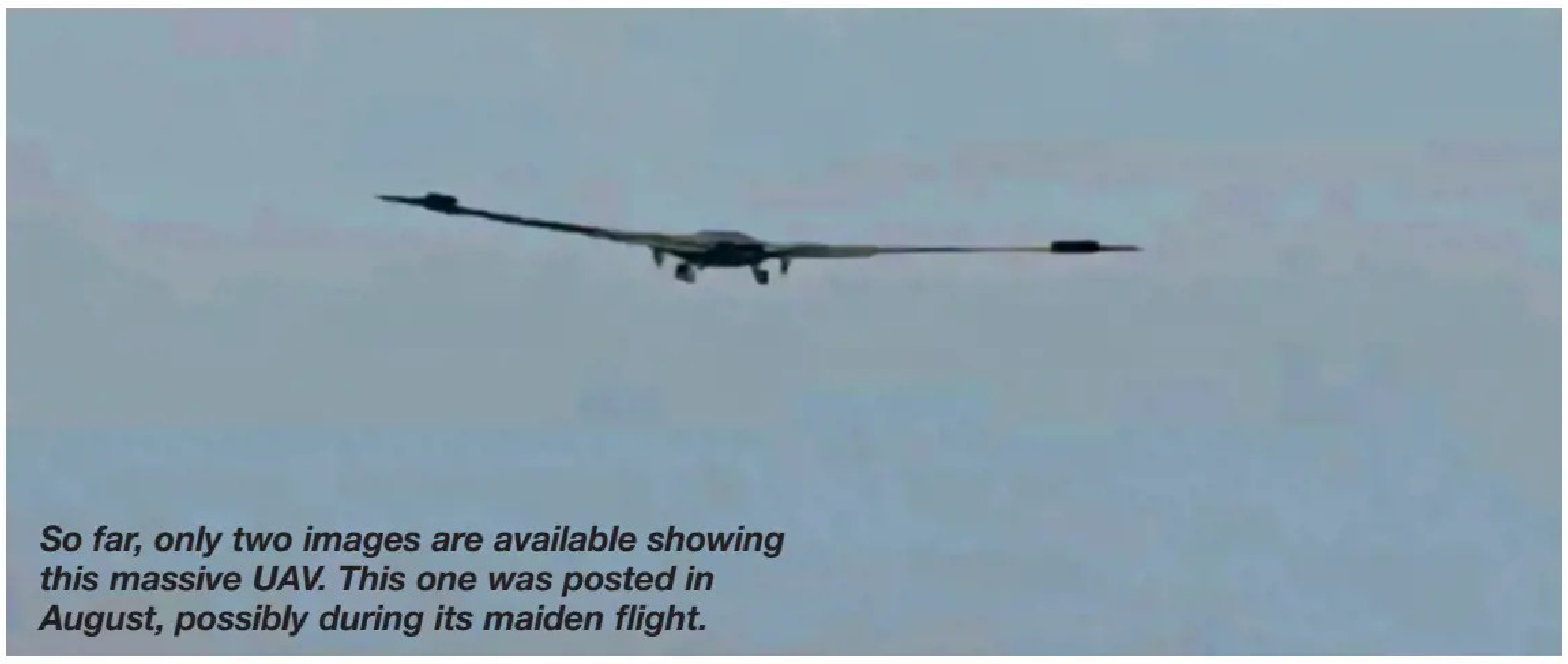
A second technology demonstrator built and test-flown recently by Harbin (HAIG) was unveiled in late August and could be a competitor to the Changhe rotorcraft. This option is tiltrotor featuring fixed engine nacelles and tilting rotors just like the Bell V-280 Valor. However, compared to the US design, this one features a traditional T-tail and is thought to be in the five-tonne class or roughly comparable to the Bell XV-15. Like Changhe's project, Harbin's design is expected to be tested thoroughly and could evolve into a family of next-generation high-speed transport aircraft that could eventually replace the Z-20 for the PLA Army. A second leaked image clearly shows that two prototypes have been built.

In parallel to this, a prototype of the R6000 unmanned transport tiltrotor UAV is undergoing engine tests for its maiden flight.



In parallel to Harbin's manned tiltrotor testbed, there is also the R6000 prototype, an unmanned tiltrotor-transport UAV which is being prepared for its maiden flight

Large long-range UAV spotted



So far, only two images are available showing this massive UAV. This one was posted in August, possibly during its maiden flight.

IN MAY 2025, a satellite image revealed that a previously unidentified very large long-range HALE reconnaissance or ISR/AEW UAV is being tested at Malan Air Base, Xinjiang. Due to the lack of information it is so far designated WZ-X. Interestingly, it has not been seen on any manufacturer's website, but on the PLAAF's main evaluation and trials site. With an overall span of about 52m and most likely twin-engined, the UAV appears similar in configuration to the US RQ-180 but much larger. In late August it was seen for the first time during a test flight – possibly its maiden flight.

Is China leading the field in CCA/UCAVs?

PERHAPS THE biggest surprise in lead up to the 2025 China Victory Day Parade on September 3 was a series of unmanned aerial systems.

Due to their size and shape, and according to insiders they can no longer be described as regular UAVs or UCAVs, but rather as Collaborative Combat Aircraft (CCA), often referred to as 'Loyal Wingmen'.

Currently, tests are underway, particularly in the USA, with the aim of using unmanned drones in conjunction with combat aircraft and controlled by remote workstations, assisted by onboard AI to fly alongside manned aircraft. These should further enhance combat effectiveness and survivability and take on particularly dangerous combat missions.

It was to be expected that China was working on similar systems and that such models were most likely already in testing, but that they would be presented at the parade, not to mention in such numbers and supposedly already in use, is surprising. Now, it can be assumed that the term 'in service' here is a rather vague synonym for 'under testing by the PLAAF or PLAN Naval Aviation', but it is nevertheless impressive that six or seven such systems are currently being developed.

Nothing is known about the manufacturers, but it is reported that all major aviation companies such as the Chengdu Aircraft Corporation (CAC), Shenyang Aircraft Corporation (SAC), Xi'an Aircraft Company (XAC) and the Northwestern Polytechnical University (NPU) are working on CCAs.

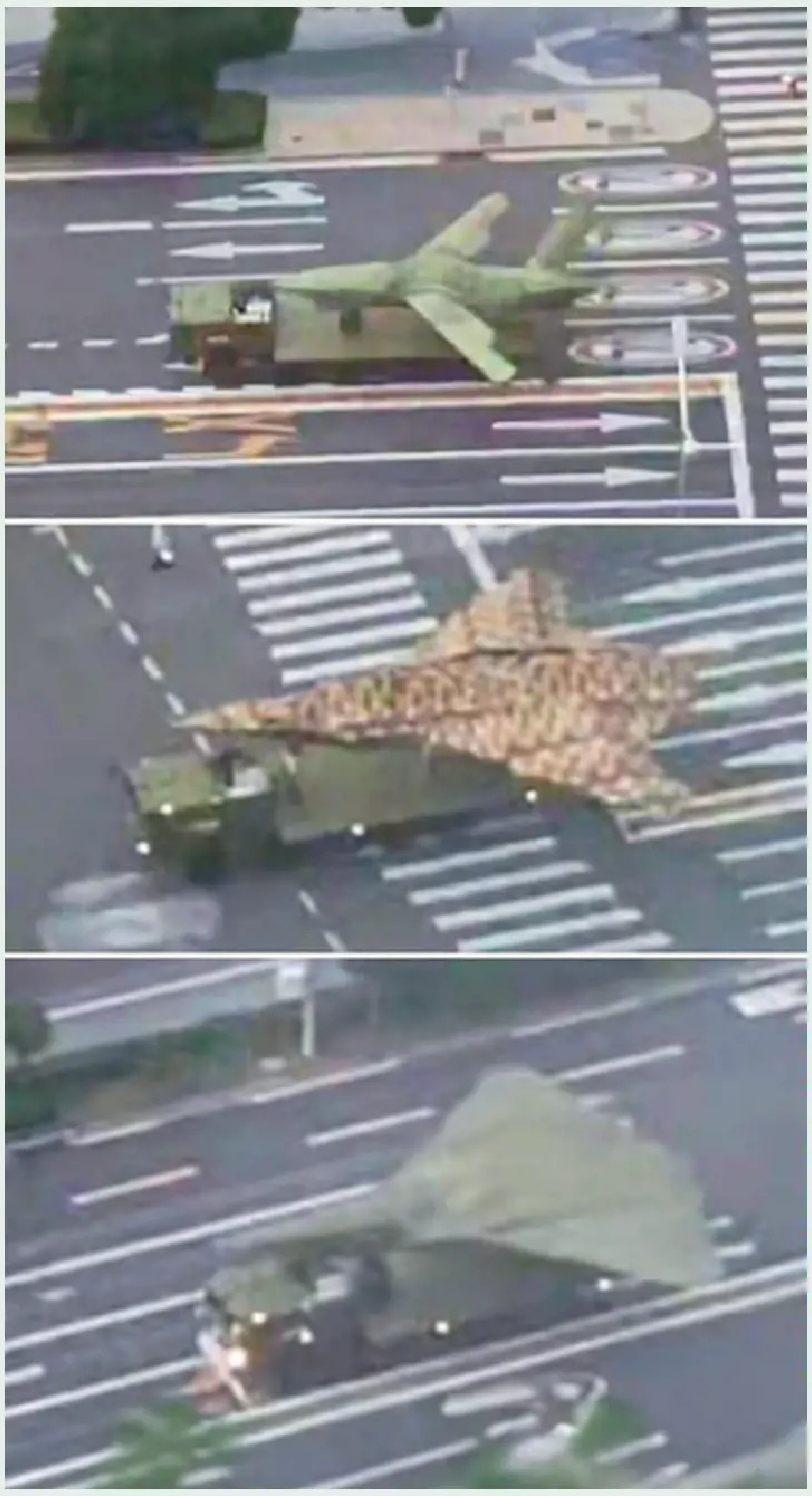
An alleged NPU testbed caused a stir at the beginning of August, when a very large delta-winged aircraft apparently completed its maiden flight in Xi'an.

Overall, video recordings and photos leaked since July suggest that at least four different types of Loyal Wingman or CCAs are either under active development or already in OPEVAL service within the PLAAF. To bring at least some order to the multitude of types, they were provisionally referred to as 'Types-X'.

According to this, the Type A and Type B feature a tailless lambda or modified delta wings and twin side engine intakes. Another one called Type C features swept wings, canted tailfins and a dorsal engine intake very similar to the earlier FH-97 or the US XQ-58A design. Type D has delta wings plus canted tailfins.

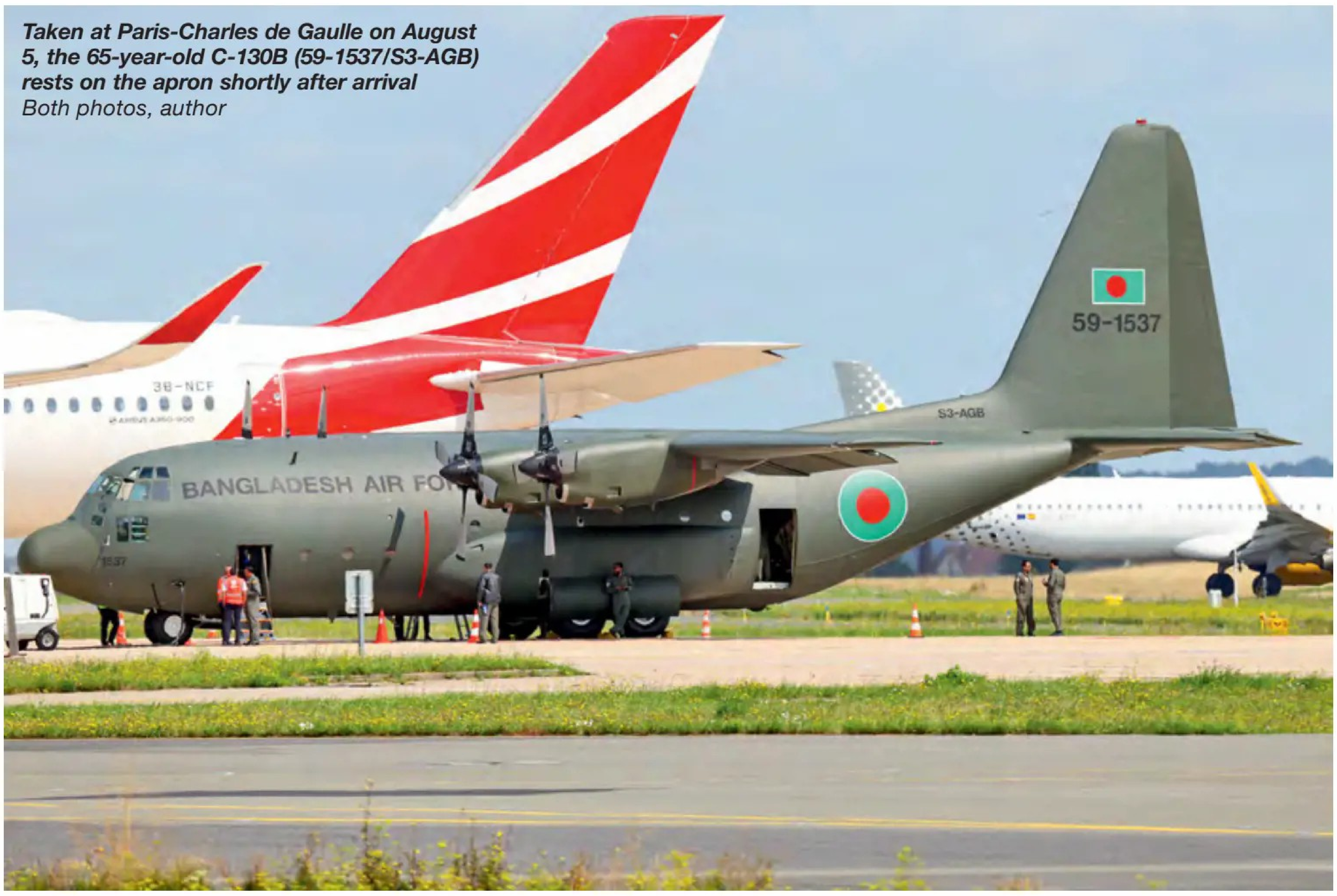
Type E again seems to be a delta-type with air intakes on top of the fuselage, while Type F appears to have a similar configuration to the Boeing MQ-28 Ghost Bat. Additionally, the already known GJ-11 UCAV and its naval variant GJ-11J (GJ-21) were also seen during the rehearsals.

Hopefully, the coming weeks will shed more light into their designations and technical details.



Given the lack of information and the poor image quality, it is currently almost impossible to identify the individual CCA/UCAVs or reveal details of their operation

Bangladeshi Herc still flying at 65



Taken at Paris-Charles de Gaulle on August 5, the 65-year-old C-130B (59-1537/S3-AGB) rests on the apron shortly after arrival
Both photos, author

DEFYING ITS 65-year age, a third overhauled Lockheed C-130B Hercules has been delivered to the Bangladesh Air Force (BAF), following completion of deep maintenance and refurbishment by Strategic Global Aviation (SGA) in Rome, New York. The arrival of 59-1537/S3-AGB at Bashar Air Base (AB) in Dhaka marks the continuation of B-model operations, although 61-0962/S3-AGC is expected to be grounded shortly, leaving two C-130Bs in service alongside the newer C-130J fleet.

The BAF's C-130B fleet has its origins in the USAF, with whom four examples entered service between 1959 and 1961. Operated until 1993/1994, they were placed into long-term storage at the Aerospace Maintenance and Regeneration Center (AMARC) in Arizona before being delivered to Bangladesh in 1999. Assigned to No 101 Squadron (also known as the 101 Special Flying Unit) at Bashar AB, Tejgaon, Dhaka, the aircraft became the backbone of the BAF's tactical airlift capability for more than two decades. In 2017, 58-0754/S3-AGA was retired from service and placed on display at Bashar AB, while the remaining three continued to serve despite their advanced age.

Among three C-130Bs still in service, 61-0962/S3-AGC was the first to undergo a major refurbishment, being overhauled and upgraded by AIROD in Subang, Malaysia, in 2014. Returned to service three years later, it was heavily tasked in support of United Nations peacekeeping missions in Africa. The second 61-2640/S3-AGD received a complete overhaul at Cascade Aerospace in Abbotsford, Canada, between 2020 and 2024, returning to Dhaka via Glasgow in March 2024. The third aircraft, 59-1537/S3-AGB was the most recent to be refurbished, completing its overhaul at SGA in mid-2025.

BANGLADESH AIR FORCE

Following extensive maintenance at Paris-Charles de Gaulle, C-130B 59-1537/S3-AGB departed for Dhaka on August 6

Its ferry flight to Bangladesh began on August 4, routing through Gander (Canada), Keflavik (Iceland), Paris Charles de Gaulle (France), Samos and Astypalaia (Greece). A technical fault on arrival in Paris temporarily delayed its progress, but a 12-member maintenance team — mostly BAF engineers led by an SGA specialist — repaired the aircraft on-site using tools and spares carried on board. It departed on August 7 and arrived at Bashar AB on August 9, ready to replace 61-0962/S3-AGC, which is due to be withdrawn from service.

The current BAF transport force comprises five C-130J Super Hercules and two operational C-130Bs. The J-models are all former RAF Hercules C5s, acquired under a July 2017 contract with the UK Ministry of Defence and modernised by Marshall Aerospace and Defence Group in Cambridge. Delivered between 2019 and 2024, the fleet consists of 99-5479/S3-AGE (ex ZH881, August 2019), 99-5482/S3-AGF (ex ZH884, May 2020), 99-5480/S3-AGG (ex ZH882, September 2020), 99-5485/S3-AGJ (ex ZH887, February 2022) and 99-5481/S3-AGH (ex ZH883, June 2024). Marshall's work included complete overhauls, avionics upgrades, a passenger transport configuration and integration of a medical evacuation capability.

While the C-130Js provide a modern, globally deployable tactical airlift ability, the decision to retain a small number of C-130Bs reflects the BAF's pragmatic fleet management strategy. By combining the proven reliability of the Hercules platform with targeted modernisation, Bangladesh is able to maintain operational flexibility and meet both domestic and international commitments. The latest overhaul by SGA underscores how even a 65-year-old airframe can remain relevant, provided the right investment and technical expertise.

Babak Taghvaee

Four Saab Gripen E/Fs sold to Thailand

THE SWEDISH government has signed an agreement to sell four Saab Gripen E/Fs to the Royal Thai Air Force.

The purchase of three Gripen Es and one Gripen F was confirmed on a recent Thai visit to Stockholm on August 25, 2025.

The deal “strengthens the long-term development opportunities for Swedish warplanes”, Swedish Defence Materiel Administration director-general Mikael Granholm said.

Saab has confirmed that the order, which includes equipment, support and training, is valued at approximately £410m, with deliveries scheduled to take place between 2025 and 2030.

Sweden’s defence minister, Pal Jonson, said: “The deal with Thailand is a sign of strength for Sweden and the Swedish defence industry. The Gripen export shows that Swedish innovation and technology build long-term and lasting collaborations. This will benefit both Sweden and Thailand for many years to come.”

Minister for Foreign Affairs, Maria Stenergard, added: “The security situation around the world continues to deteriorate. A strong Swedish defence industry is a prerequisite for us to be able to take greater responsibility for our security and strengthen our relations with other countries.”

Thailand has purchased three Gripen Es and a dual-seat F *Linus Svensson/Saab*

This sale will enhance the Gripen programme, allowing Saab to further develop production, while also boosting Swedish industry and strengthening operations within the Swedish Armed Forces.

Thailand already has a squadron of Gripen C/Ds, and it is expected that more agreements will follow, with Thailand purchasing up to 12 Gripen E/F series.

Japanese F-35B deliveries start

The third F-35B destined for the Japan Air Self-Defense Force returns to Naval Air Station Fort Worth Joint Reserve Base and prepares to make a vertical landing at the conclusion of a test flight on July 17, 2025. This jet is now serving with the JASDF’s 202nd Hikotai at Nyutabaru. *Keith Snyder*

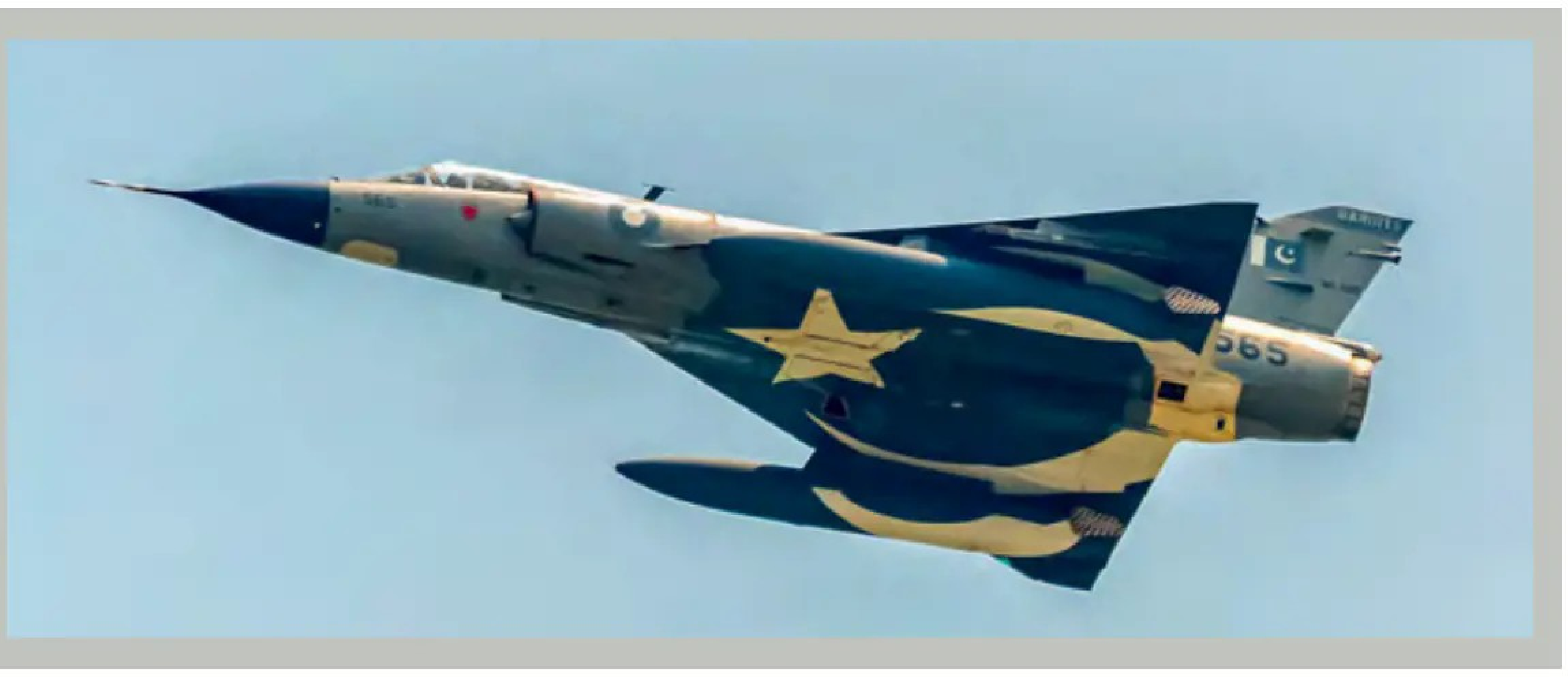
WITH FLIGHT testing accelerating, Lockheed Martin is preparing to deliver the initial F-35Bs to the Japan Air Self-Defense Force, at its facility in Fort Worth, Texas. Japan’s first F-35B entered flight testing on May 12, 2025. The group of four fighters will begin their delivery flights to Japan in early August. Acquisition plans include 42 F-35Bs that will operate from the Japan Maritime Self-Defense Force’s Izumo-class helicopter destroyers JS *Izumo* (DDH-183) and JS *Kaga* (DDH-184). The F-35Bs will be based at Nyutabaru Air Base on the island of Kyushu. Training, including vertical landings and field carrier landing practise, will eventually be relocated permanently to a future air base on the uninhabited island of Mageshima. Completion of that facility, located 24 miles south of Kyushu, has been pushed out from 2027 to March 2030. Japan plans to field two F-35B squadrons by 2030. Although F-35As are being produced locally in Japan, the F-35Bs are assembled by Lockheed Martin in Fort Worth. Masanori Ogawa reports from Japan that the first three aircraft, 59-8201, 59-8203 and 59-8204 were delivered on August 7 to the Rinji F-35B Hikotai at Nyutabaru on August 7, the unit was subsequently re-labelled the 202nd Hikotai.

Tom Kaminski

Special Mirage roars

A PAKISTAN Air Force Mirage IIIEA from No 7 Sqn ‘Bandits’ roars over the capital Islamabad in a low flypast. Its special Independence Day livery on August 14, 2025, the crescent and star painted boldly on the belly, adds pride to the rehearsal for the National Day flypast

Rana Suhaib



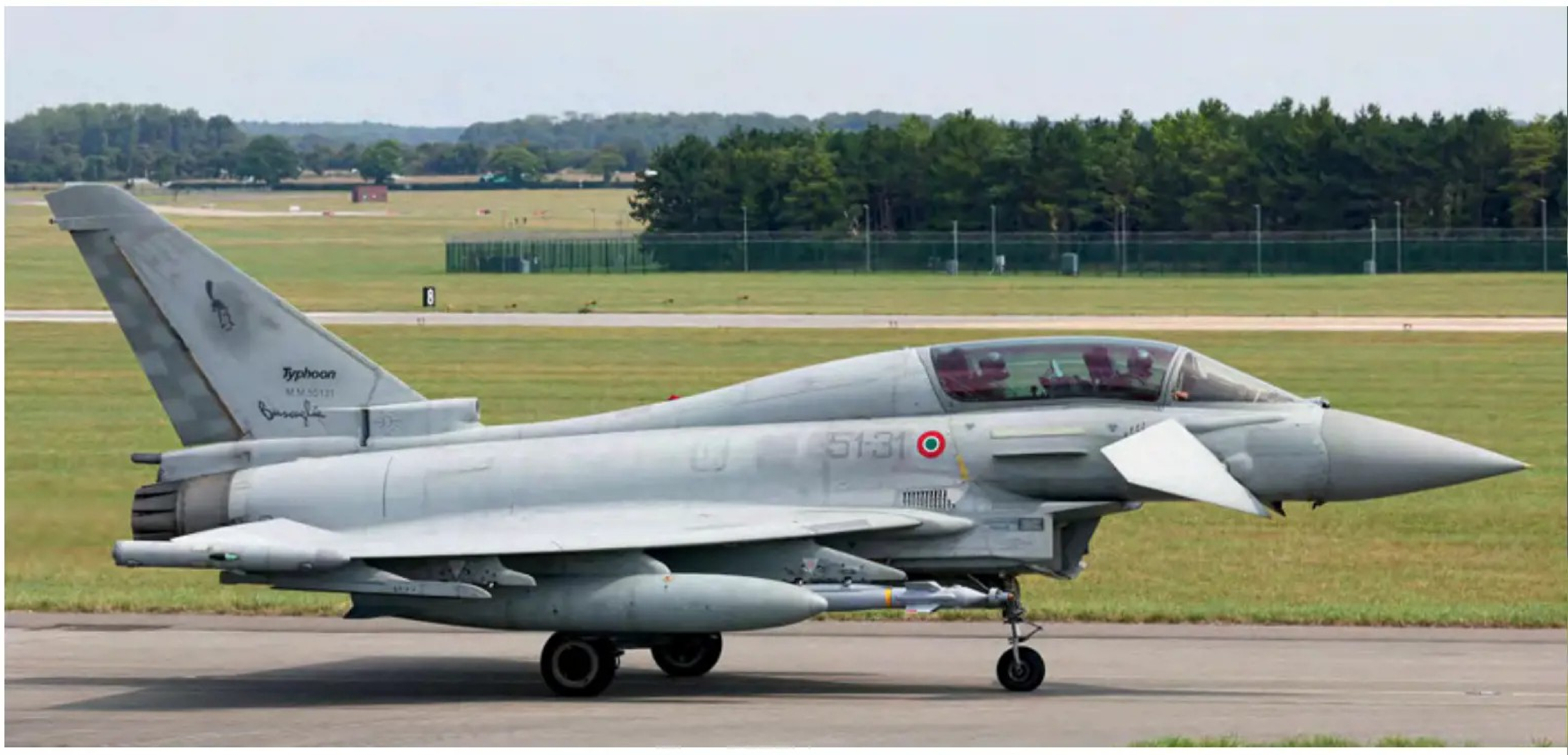
Interesting Places

Just Passing Through

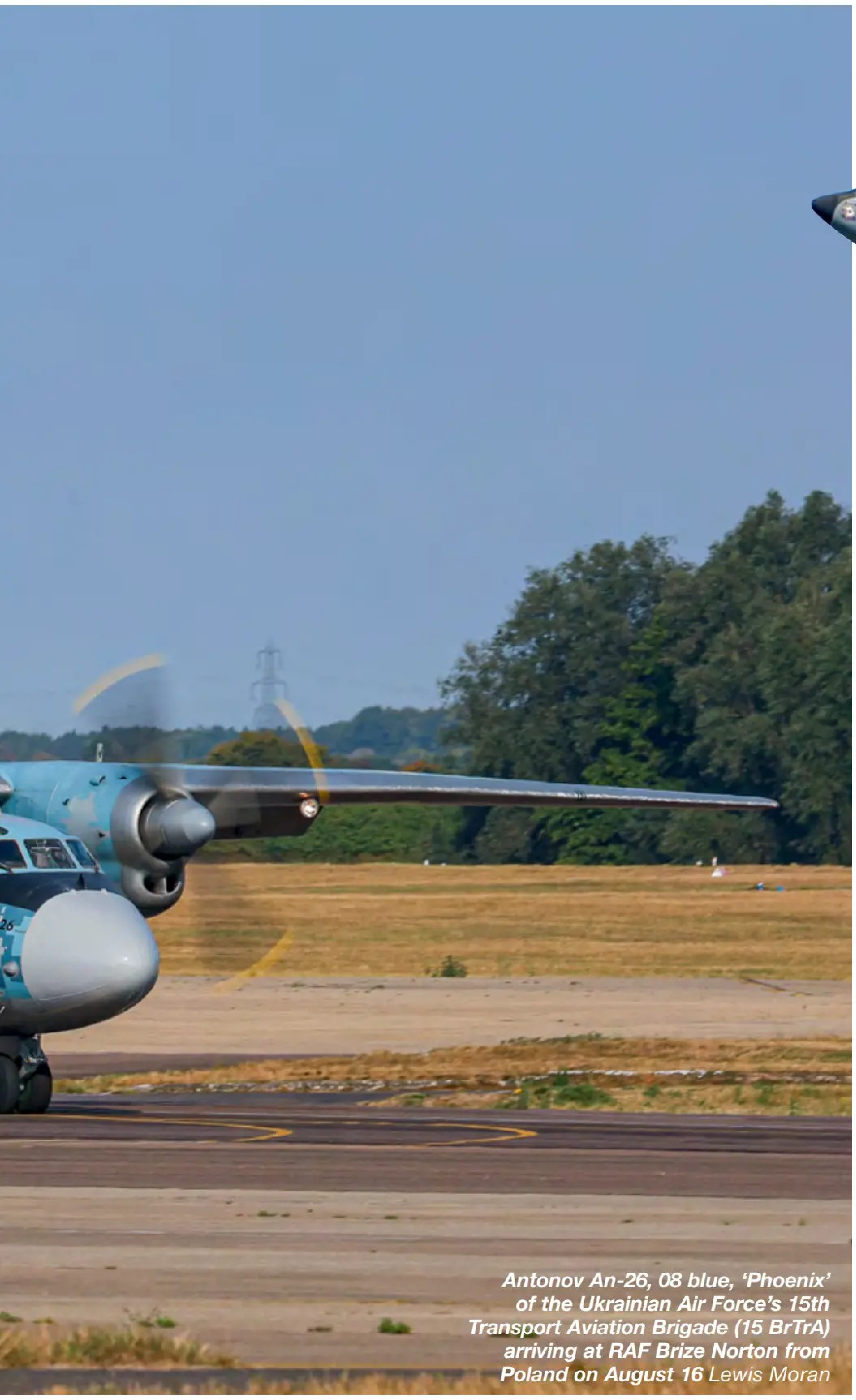
Ben Stanley Hall showcases the rich diversity of aircraft movements up and down the UK

A couple of our picks this month could well be final visits to these shores, with the impending retirements of both the German Navy Super Lynx Mk88 and the USAF EC-130H Compass Call. We also have a pair of tanker-transport aircraft, a light to medium transport that has been repurposed as a VIP/personnel aircraft and, finally, a good old grey and pointy fast jet, toting some live ordnance.

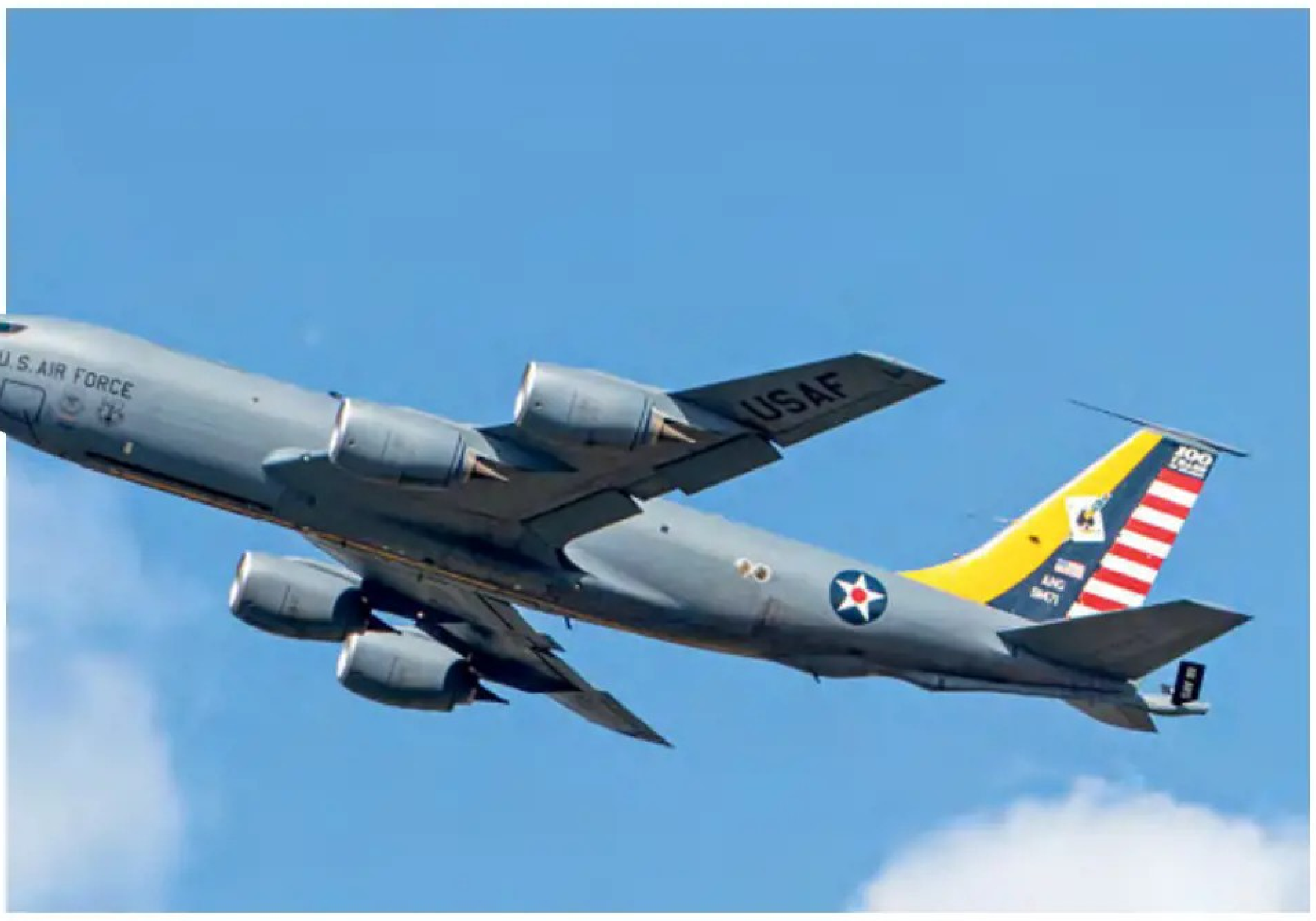
We welcome contributions from readers across the world. If you photograph an aircraft that is not in its usual location or could be of interest, please email your images, without watermarks, to ben.hall@keypublishing.com using the subject heading 'Just Passing Through', with a short caption including as much information as possible. **afm**



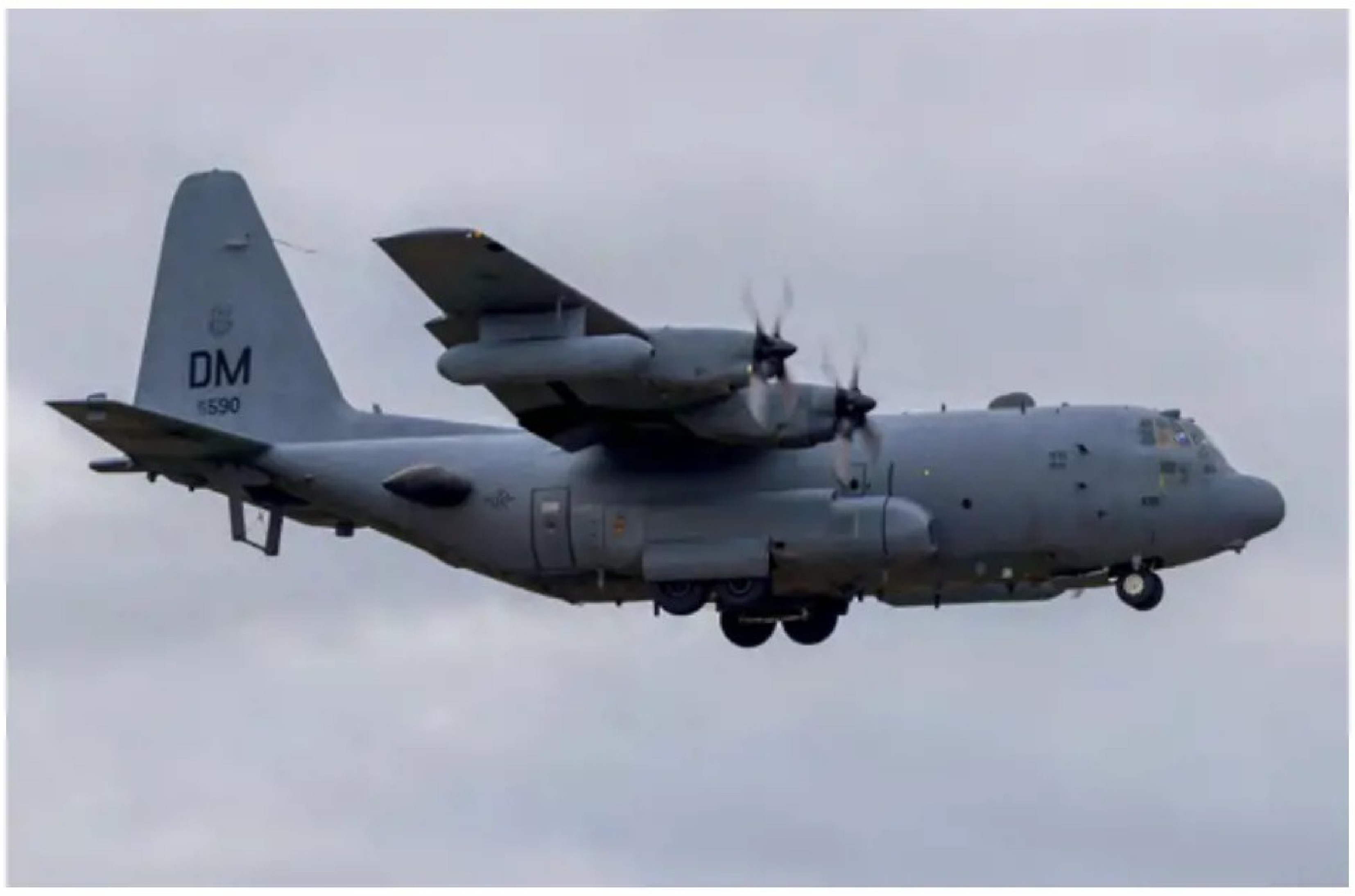
Above: ***One of three Italian Air Force F-2000A Eurofighters that deployed to RAF Marham, Norfolk, for weapons trials using the Paveway IV at Aberporth Range in Wales. Usually this TF-2000A twin--seater MM55131 is operated by 51° Stormo based at Istrana AB but for these trials, two twin-seaters were used by the test unit Reparto Sperimentale Volo (RSV). The sole single-seater is usually based at Grosseto AB with 4° Stormo*** *Karl O'Kan*



Antonov An-26, 08 blue, 'Phoenix' of the Ukrainian Air Force's 15th Transport Aviation Brigade (15 BrTrA) arriving at RAF Brize Norton from Poland on August 16 *Lewis Moran*



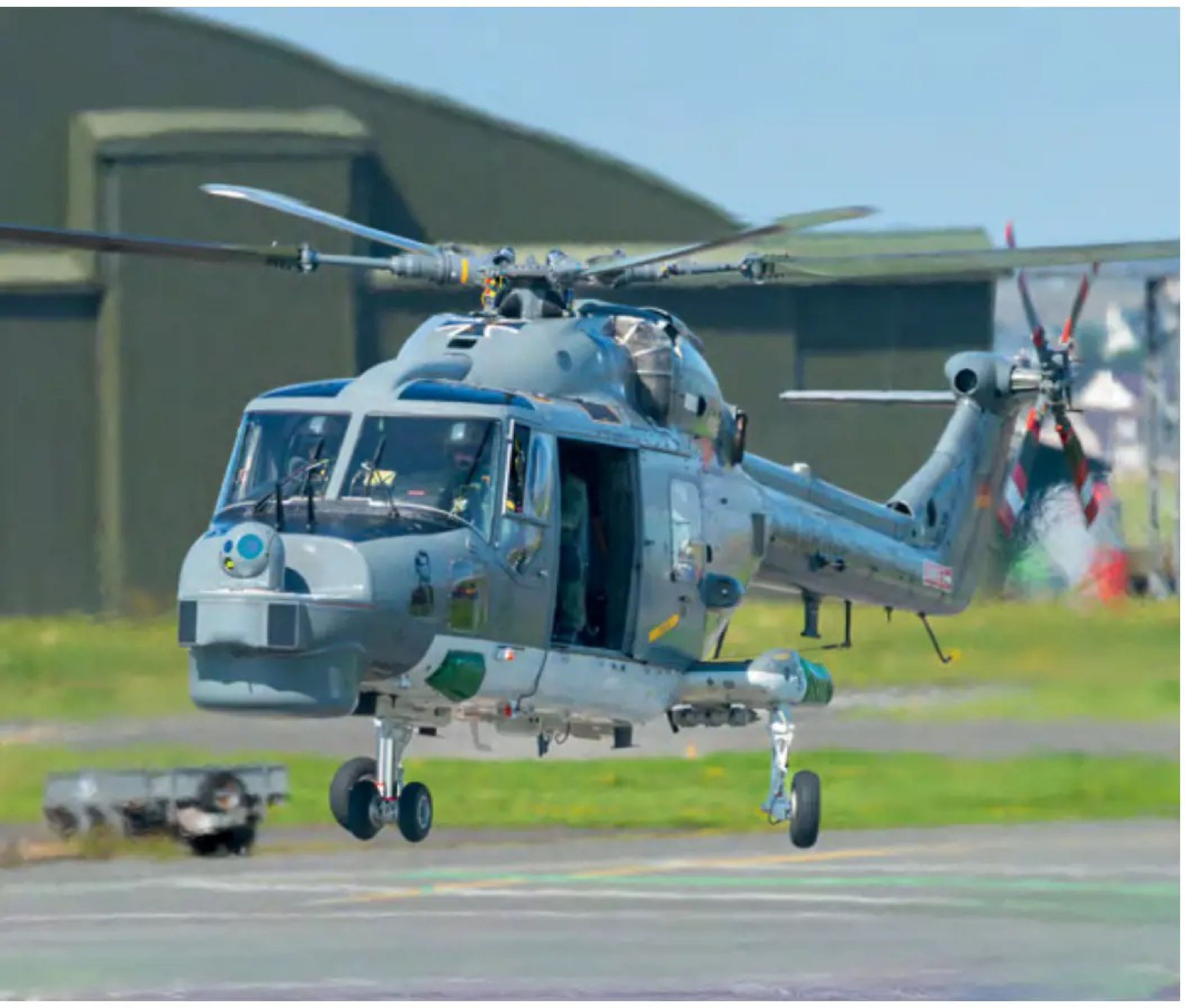
Above: ***Departing RAF Mildenhall is KC-135T, 59-1471, of the 141st Air Refueling Wing, 116th Air Refueling Squadron, part of the Washington Air National Guard, wearing centenary anniversary colours and using callsign 'REACH834' on August 5*** *Andrew McKelvey*

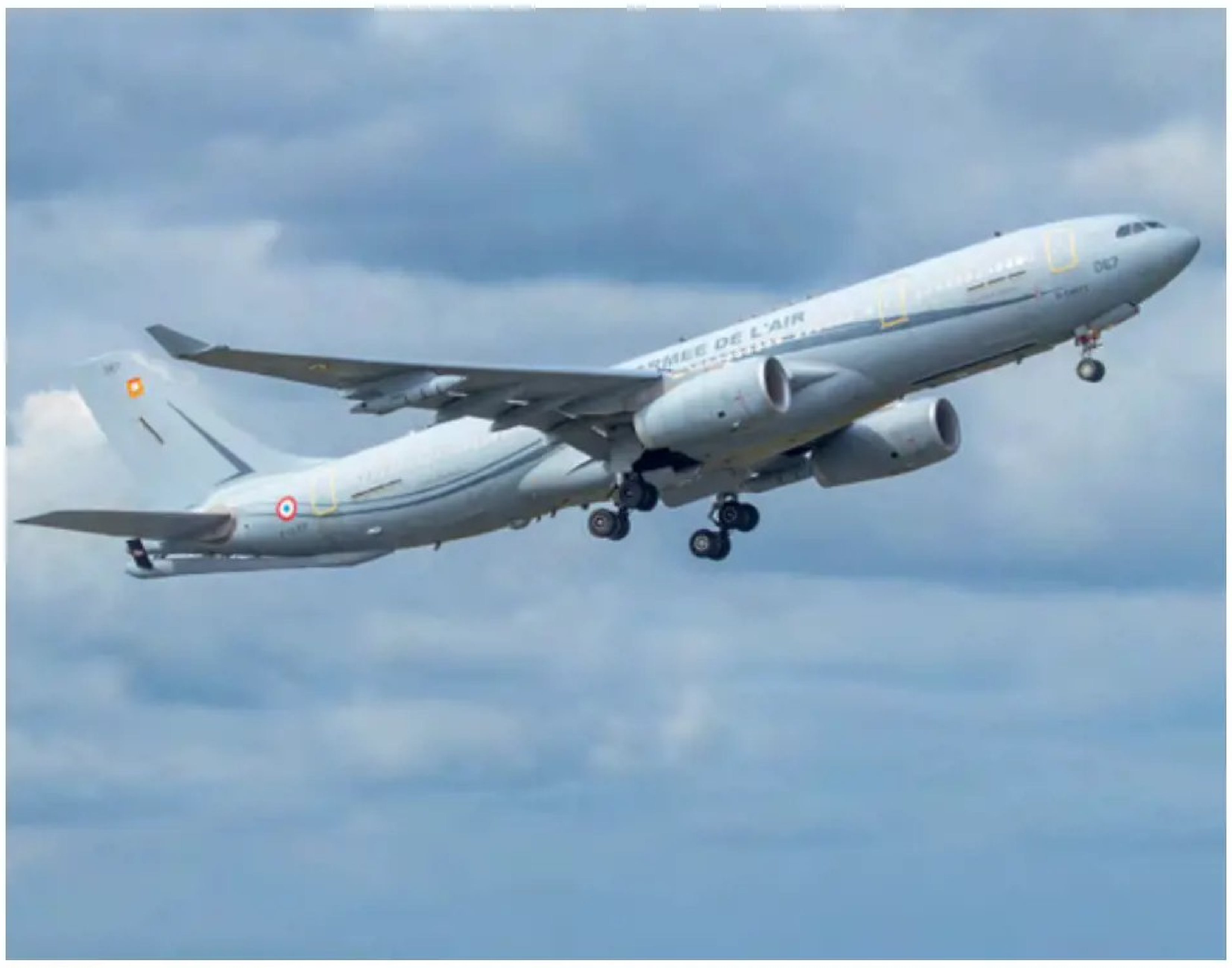


Above: ***USAF EC-130Hs AXIS21 and AXIS33, 73-1590 and 73-1594, from the 43rd Electronic Combat Squadron based at Davis Monthan AFB on what will probably be their final visit to the UK before being withdrawn from service. Both aircraft transited from the Middle East to Souda Bay, Greece, then onto Aviano Air Base, before arriving at RAF Mildenhall on August 20*** *Ali Hunt*

Below Left: ***Possibly the last chance to see a German Navy Super Lynx Mk.88A, 8318, visiting Stornoway. This is one of two operating from the*** *Jason Spinks*

Below: ***Making a first visit to Glasgow Airport was this French Air and Space Force Airbus A330-243 Phenix. The aircraft, 067/'F-UJCP', arrived and departed to Evreux-Fauville Air Base on a training sortie*** *B1 Images*





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850/25

Stuck in First Gear?

Tim Ripley reviews the recent National Audit Report on the UK's acquisition of the Lockheed Martin F-35B, and the sheer scale of the cost

In July, Britain's spending watchdog delivered its verdict on the Lockheed Martin F-35B Lightning II. It ran something like this: "Great plane, great capability, but it is costing a fortune and our jets have real problems getting in the air."

The National Audit Office's (NAO) report, *The UK's F-35 capability,* gave the first independent verdict on more than 25 years of effort by the Royal Air Force and Royal Navy to buy the fifth-generation combat aircraft.

Its hard-hitting assessments, not surprisingly, made uncomfortable reading for the Ministry of Defence (MOD), which said it would deliver a considered full response "in due course".

The report is full of information the MOD has not publicly released before, and it tells a far more complicated story than the usual defence procurement announcements.

Running through the pages, you can see Britain's near total dependence on the aircraft's manufacturer Lockheed Martin and the US Department of Defense to keep the jets fit to fight. The MOD seems reluctant to publicly criticise its American allies or admit that it is demanding changes to the support arrangements that are crippling the build-up of Britain's F-35B capability. This would also involve the MOD, RAF and Royal Navy saying they made mistakes in signing up to arrangements for the supply of spare parts that are now clearly a bad deal.

Astronomical cost

The NAO reveals that up to the end of March 2025, Britain had spent £11.5 billion on buying and operating 38 F-38Bs, and the meter is still running. That includes not just the cost of the jets, but engines, weapons, simulators, engineering equipment, airbase infrastructure, personnel training, contributions to the design and development of the aircraft, as well as 'sunk' money spent on the F-35C between 2010-12 when Britain briefly toyed with buying the tail hook-equipped carrier variant before switching to the jump jet B model.

This all works out at more than £300 million per jet despite the sticker price for each being less than $100 million each. Getting into the F-35 business does not come cheap.

Only 38 of 48 British F-35Bs have been delivered, a rate much slower than that of Australia, Norway and the Netherlands. The last 10 should be delivered by April 2026 *Photos, Alan Warnes unless stated*

“This all works out at more than £300 million per jet, despite the sticker price for each being less than $100 million each”

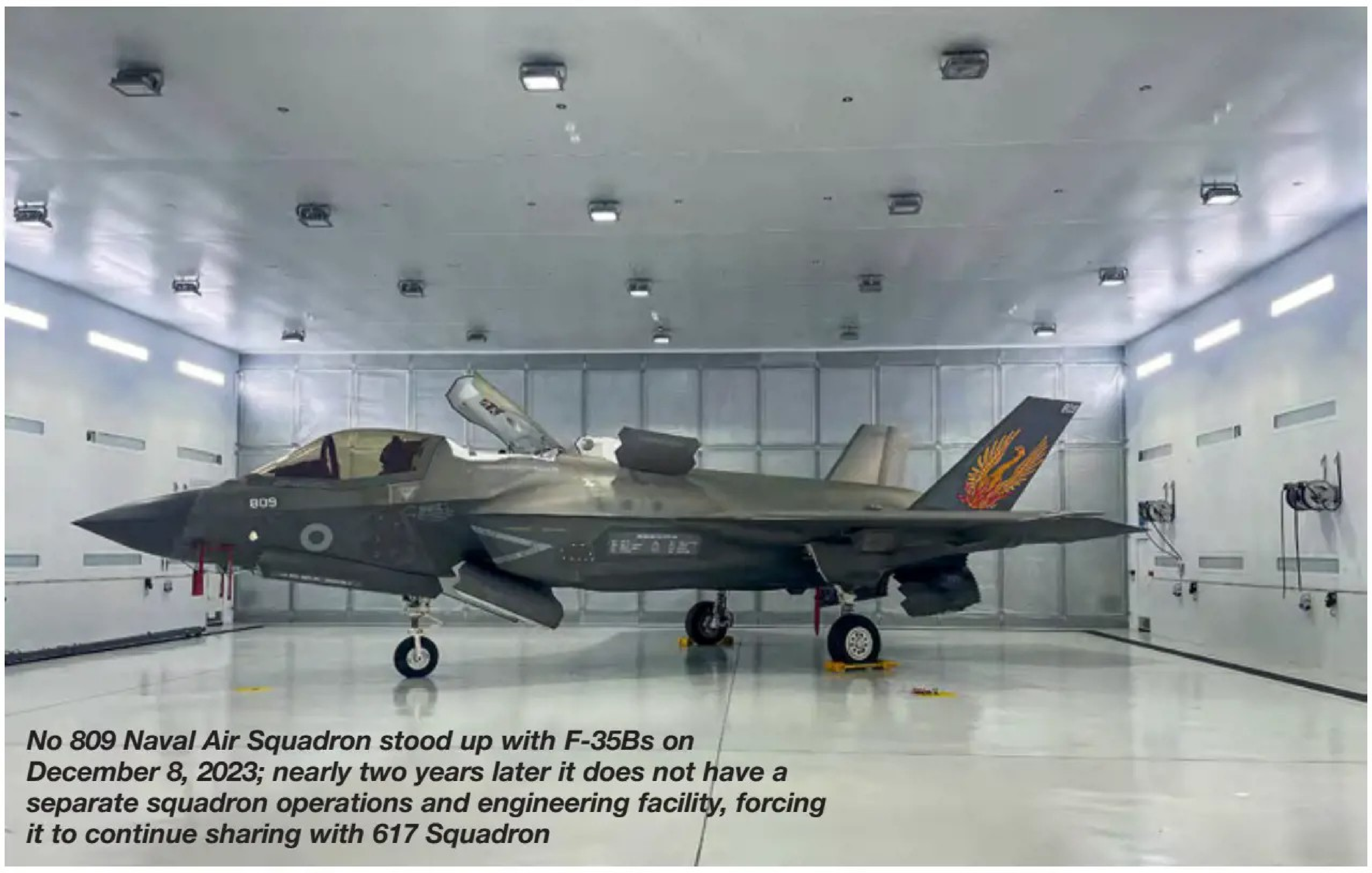
MBDA
MISSILE SYSTEMS

The delays with Block 4/TR3 F-35s mean the MBDA Meteor (top) and the MBDA SPEAR 3 (bottom) will not now be integrated until the 2030s. ASRAAM is in the middle

If the MOD's purchase of 48 F-35Bs cost £18.76bn, that puts the price of the F-35B at £390 million each!

NAO auditors were not very happy with the MOD's own cost estimates, which said that only £9.35 billion had been spent to date. The NAO revealed that the MOD costings did not include £1.5 billion of spending on personnel, infrastructure, training flights, sunk costs and other overheads.

Keeping the F-35B in service over the coming decades is going to cost even more with the NAO accusing the MOD of dramatically underestimating the final bill. According to the NAO, the MOD first came up with the figure of £18.76bn as the whole life costs of the programme. But the NAO pushed back saying this only covered the cost of 48 jets out to 2048, despite the MOD wanting to buy 137 F-35s and keep them in service to 2069. The MOD came back with the figure of £57bn, but the NAO disputed this, saying it did not include a load of extras. These amounted to an extra £14bn, bringing the total cost to whopping £71bn



No 809 Naval Air Squadron stood up with F-35Bs on December 8, 2023; nearly two years later it does not have a separate squadron operations and engineering facility, forcing it to continue sharing with 617 Squadron

Depending on how you do the maths, the F-35 is one of the most expensive defence projects in British history. It is certainly likely to end up as the most expensive aircraft ever bought by the MOD. The 160 Eurofighter Typhoons are expected to cost £37bn until they go out of service in 2040, working at £231 million a jet. Even on the MOD's own data, if 48 F-35Bs are bought for £18.76bn, that puts the cost of the F-35B at £390m each. If the MOD does buy 138 F-35s at £71bn, that works out at £514m per jet.

Availability through the floor

The most damming sections of the NAO report cover how many of Britain's jets are fit to fly and fight.

Perhaps saving the MOD's blushes, the NAO did not reveal the actual data, citing "national security" reasons. Fortunately, the Pentagon makes this data available to the US Congress, which routinely publishes it. However, the NAO gives the game away by saying the UK availability target for its F-35 fleet "is significantly below the [Pentagon] target for the global F-35B fleet".

Between October 2024 and January 2025, the NAO said the UK's F-35B fleet's availability was three-fifths (60%) of the global F-35B fleet.

In June 2025, the US Congressional Budget Office (CBO) reported that the US Marine Corps had set an availability rate – which is how many jets are fit to fly each day – of 65% for the F-35B, but that it only actually achieved an availability rate of slightly below 50%, and with a downward trend.

That means on average less than half of US Marine Corps F-35Bs were fit to fly on any given day. So, if the British achieved that level of availability, at best only 19 jets a day were fit to fly, but the NAO says the level is 60% of that, or 11 jets.

The situation is even worse for mission capable rates, which are defined by the NAO as being able to fly and perform at least one of seven F-35 mission sets. This incorporates not just aircraft being able to fly, but crew training, weapon availability, defensive counter-measures and other combat capabilities. Its assessment of this key metric is very blunt: "It did not come close to the target in any individual month," said the NAO. "The UK fleet achieved one-third of the MOD's target for full month capable rate – the time that aircraft could fly and perform all the required missions."

Again, the MOD claimed this was all top secret, but the NAO said British mission-capable targets are lower than their US counterparts. The CBO reported in June that the USMC F-35B rate was 16%, or one-in-six aircraft, fully capable of flying all combat missions. For the British F-35B force, that translates into just six aircraft that are fully fit to go to war, at best.

The NAO attributes this lamentable state of affairs to a shortage of engineers and spare parts, as well as an emerging issue with higher corrosion than expected from operating the aircraft in maritime environments on aircraft carriers.

In June 2025, the Prime Minister Sir Kier Starmer announced that Britain would expand its F-35 force by buying 12 conventional take-off and landing F-35As

Flawed support system

A major focus for the NAO is the F-35 Global Support Solution (GSS), which is run for the Pentagon's F-35 Joint Program Office (JPO) by Lockheed Martin. This 'just in time' system controls the supply of all F-35 spare parts centrally, via a computer network based in the United States.

Like modern cars, when a part fails on the F-35 the drill is to simply take it out and put in a new one. These parts are not designed to be repaired on airfields, but sent back to factories to be refurbished or thrown away. As a result, if there are not enough spare parts available at RAF Marham in Norfolk then the RAF's jets will not fly. It is the same for every F-35 operator.

The way the GSS operates serves to compound this situation, in spades. The GSS was devised in the era when a 'just in time' logistic was seen as the panacea to almost all problems. By giving Lockheed Martin a monopoly position as the sole supplier of spare parts, via the GSS, the JPO has given the company a critical role. When the GSS was devised more than 20 years ago, the idea was that huge economies of scale could be achieved if Lockheed Martin bought all the spare parts at the same time, for all F-35s operators across the world. This would save on the cost of operating the aircraft, or so it was claimed.

It did not turn out like that. The NAO reveals that production of F-35 spare parts has not kept up with the growth of the fleet. So there are not enough to go around, leading to hundreds of jets being parked up around the world waiting for spare parts. The need to boost production of new jets for new customers has made the situation worse as key components are diverted to the Fort Worth production line in Texas, rather than put in the GSS spare parts pool.

To make matters seem even more dysfunctional, the NAO reports that Lockheed Martin is controlling the GSS and countries are not able to build up their own stockpile of spares. The company owns all the spares until they are installed on jets, even if they are in storage at RAF Marham.

Britain has been able to secure two deployable spares packs for use in operations, but both of those have deployed on HMS *Prince of Wales* for Operation Highmast. The NAO predicts that when the aircraft carrier returns from the Pacific later this year, the supply of spare parts will return to 'business as usual' under the GSS arrangements.

Also, the GSS is run across a dedicated computer network, called the Autonomic Logistics Information System, or ALIS, but it has not worked properly, is seriously delaying the delivery of spares and is impacting on aircraft availability. It is being replaced by a new system called ODIN. The JPO has yet to set a date for when ODIN will be ready to take over from ALIS, says the NAO.

Hobbled by savings, delays, shortages

If the systemic problems of the US-led F-35 programme are not enough, the build-up of the UK F-35B force has also been bedevilled by unique British problems.

When the UK stood up Joint Force Lightning in 2018, the requirement for engineers was miscalculated and no allowance for made for engineers being off sick, on courses or on holiday. This has meant there are not enough trained staff to allow the second operational unit, 809 Naval Air Squadron, to stand up a fully functioning unit. In 2023, the MOD approved the recruitment of 168 more engineers, but they are all not expected to be in place until 2028. Shortages are particularly acute at supervisory levels, with RAF Marham only having 58% of the required number of senior engineers, compared with 80% across the wider RAF.

There is also a shortage of F-35B pilots, but the NAO does not give detailed numbers on grounds of national security. It does reveal that the operational conversion unit only has five of its allocated 16 instructor pilots.

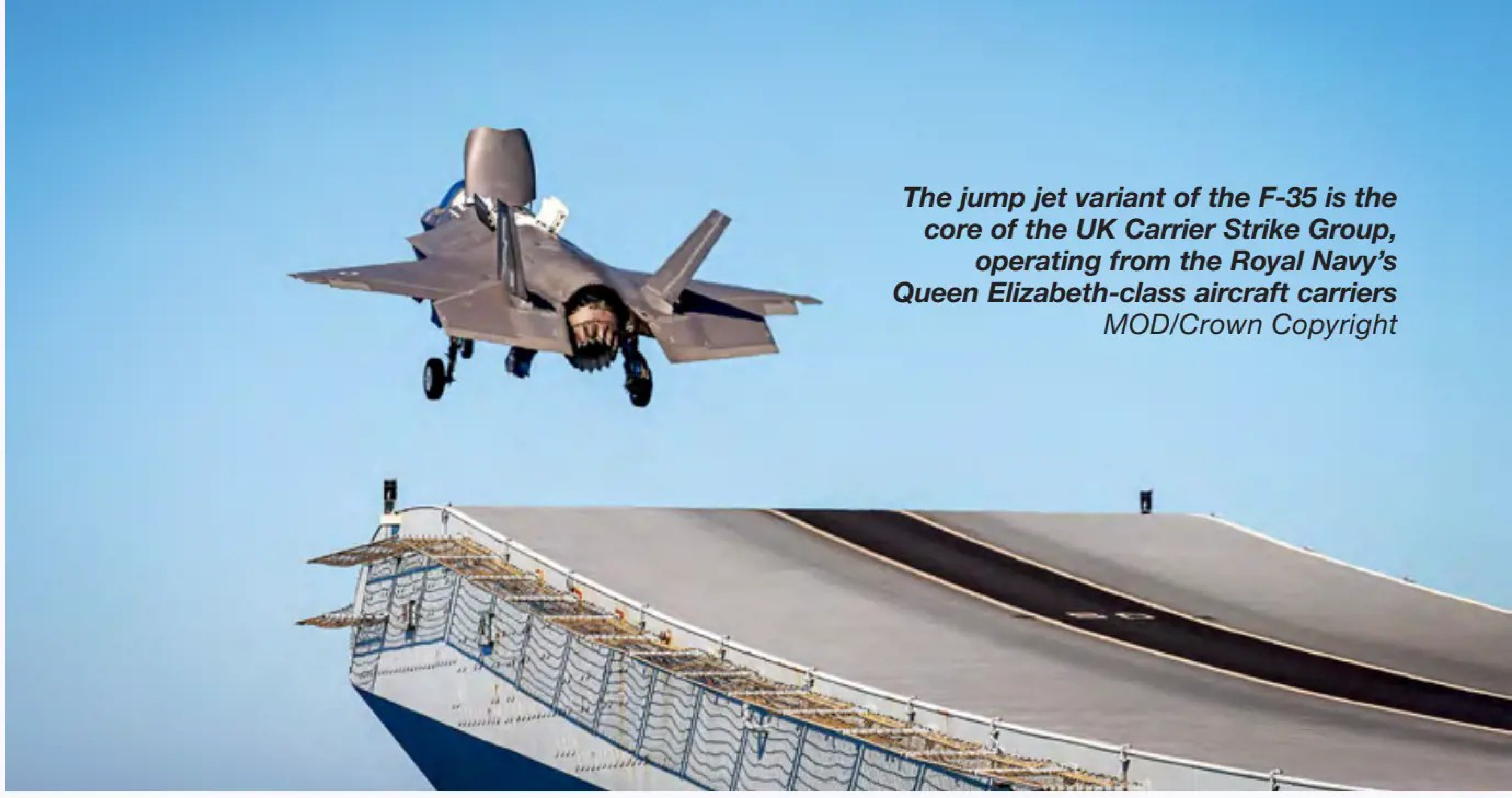
The shortage of pilots and engineers has not been helped by the fact that the home of the UK's F-35B at RAF Marham in Norfolk is perhaps one of the worst RAF stations, in terms of infrastructure and accommodation. In an attempt to overcome the accommodation crisis, personnel have been put up in hotels and a programme was launched to build new temporary accommodation, scheduled to open in September 2025.

Skimping on spending by the MOD has also limited the build-up of the engineering

"The report is full of information the MOD has not publicly released before"

The first four F-35Bs were delivered to RAF Marham on June 7, 2018 infrastructure at RAF Marham, with plans to build an Aircraft Signature Assessment Facility (ASAF), which is considered essential to repair the 'stealth' coatings of the F-35B jets, being delayed to an unspecified point next decade. As an interim, the UK now sends its F-35s to Italy to get their low-observable coatings maintained.

It has also not yet been possible to build a separate squadron operations and engineering facility for 809 Naval Air Squadron, forcing it to continue sharing with 617 Squadron. It will not be truly sustainable unit 2028, according to the NAO.



The jump jet variant of the F-35 is the core of the UK Carrier Strike Group, operating from the Royal Navy's Queen Elizabeth-class aircraft carriers *MOD/Crown Copyright*

17:15Z Flight safety is EVE
17:20 12 F1B → 350
17:20 23 FPD → 500
17:20 29 F1C → 500
17:25 22 F1A → 350
17:26 03 BPC → 500

RAF and Fleet Air Arm deck crews on HMS Prince of Wales are amassing a huge amount of experience operating the F-35B during Operation Highmast *MOD/Crown Copyright*

Jets, jets

Many observers have wondered why the UK's build-up of F-35s has been considerably slower than other nations, with Australia, Norway and the Netherlands taking delivery of nearly all their jets ahead of Britain. The NAO reveals that this was deliberate. It had been intended for all the British jets to be delivered by the end of 2024, but the NAO says that in 2020 the MOD decided to push this back to the end of 2025 in a bid to save money. In the meantime, the Block 4/TR3 upgrades delays now mean that deliveries of the last nine jets have been pushed back until April 2026.

The Block 4/TR3 debacle is also confirmed by the NAO as being the reason why the UK F-35Bs will not be able to integrate British-made MBDA Meteor air-to-air missiles and MBDA SPEAR-3 air-launched cruise missiles until early in the 2030s.

This means the main ground-attack weapon currently available to the UK F-35Bs is the Raytheon Paveway IV laser/satellite-guided bombs, which need to be dropped by a jet flying directly over a target. "Paveway IV

In July 2025, HMS Prince of Wales docked in Darwin, the first British aircraft carrier's visit to Australia since 1997 *MOD/Crown Copyright* lacks the range to be an effective stand-off weapon," says the NAO. "This means the UK F-35 cannot currently perform all missions against ground-based targets at a safe distance." In effect, this negates much of the advantage the F-35's stealth performance gives the RAF when it comes to penetrating hostile air defences to attack heavily defended enemy targets.

As a result in of the slow delivery of aircraft, poor availability, lack of stand-off weapons and delays in fully standing up 809 Naval Air Squadron, the NAO questions whether the UK Lightning Force can really meet its full operating capability (FOC) target at the end of this year. In response, the MOD told the NAO that it remains on track to meet FOC, although the auditors revealed that to do this the MOD would still have to declare 20 exceptions to its FOC criteria.

Delays in building infrastructure and accommodation has dogged the build-up of the UK Lightning Force *MOD/Crown Copyright*

Future prospects uncertain

The MOD points to the strong showing that Britain's F-35Bs are making on Operation Highmast in the Far East; a real-world demonstration that the jet is delivering for the RAF and Royal Navy. However, the NAO is not convinced. It says the shortage of spare parts, lack of trained personnel and availability of aircraft, plus poor infrastructure, are set to continue for many years to come. Solutions to all these issues are far on the horizon.

While the MOD has some levers to pull to recruit more personnel and fix leaking roofs at RAF Marham, some are completely outside the control of the British government. Only the US JPO and Lockheed Martin can resolve the Block 4/TR3 problems, speed up delivery of spare parts and fix the broken GSS.

The NAO reports strong user feedback from F-35 personnel, praising its stealth capabilities, electronic warfare systems and sensor fusion features. However, these have to be balanced against huge costs and limited availability.

This leaves readers of the NAO report wondering if Britain can afford to buy a few dozen more of these jets, let alone take delivery of 138 F-35s. If the RAF and Royal Navy can't get their 38 jets fully operational after spending £11.5bn, how much will it cost if more jets are ordered?

The June decision by Prime Minister Sir Kier Starmer to order a dozen conventional take-off and landing F-35A variants looks rather odd in this context. The MOD claims the A model jets are cheaper to buy and operate than the F-35B jump jet variant. It would be very interesting to see if those claims survive scrutiny in the NAO's next F-35 report. **afm**

RAF Marham has been home to the UK Lightning Force since 2018 *MOD/Crown Copyright*

The F-35's tactical edge in SEAD/DEAD missions

In the classic text *The Art of War*, **Sun Tzu** wrote: "Attack where the enemy are unprepared. Go forth where they will not expect it." Though written nearly 2,500 years ago, this wisdom remains relevant today, as Mina Adel discovered

A Royal Netherlands Air Force F-35A approaches a USAF KC-135 Stratotanker to take on fuel *Ben Stanley Hall*

With their advanced capabilities to penetrate deep into enemy territory and inflict concentrated damage on air defences, stealthy jets are designed to disrupt and break an adversary's decision-making cycle. By the time the enemy begins to react, these aircraft may have already completed their missions and be en route back to base, leaving behind a tactical footprint that can be exploited in future operations.

The F-35 has long been the subject of intense discussion and analysis, not only as one of the most advanced fighter aircraft but also one of the most controversial. However, recent developments in the Middle East have slightly shifted this narrative. To assess the aircraft's actual capabilities in one of the most critical and dangerous missions – suppressing or destroying enemy air defences (SEAD/DEAD) – *AirForces Monthly* spoke with two experts: Professor Justin Bronk, senior research fellow for airpower and technology at the Royal United Services Institute (RUSI), and Mike Mihajlovic, a former Serbian air defence operator and author of several books on air defence systems.

Lightning strike

As older generations of fighter aircraft evolved, intensive work was done to enhance their speed, manoeuvrability and armament, culminating in the development of the F-117 and its influence on creating the world's most powerful air superiority fighter, the F-22, which possesses exceptional capabilities in both beyond- and within-visual-range aerial combat. Parallel efforts were underway to develop a multirole stealth aircraft capable of penetrating air defences and delivering deep strikes. This coincided with the rise of advanced air defence systems in the early 2000s, which operate under the anti-access/area denial (A2/AD) strategy. As a result, the F-35 was designed with a unique philosophy to confront and adapt to these emerging threats.

Justin Bronk explained: "The F-35 is particularly well suited to SEAD/DEAD operations, being primarily designed to excel at that mission set. The combination of stealth, superb sensor suite and electronic self-defence capabilities allows it to geolocate, suppress and designate hostile SAM radars as targets, either using its weapons or for stand-off strikes from other non-stealth fighters or ground-based launchers further back."

The key feature of F-35 is sensor/information fusion, with data from different subsystems (radar, radar warning systems, EOTS, DAS and datalink) being collected, compared and integrated in a single intuitive battlespace depiction in the tactical situation display, providing the pilot with unparalleled situational awareness. To enhance accuracy, the F-35 has many sophisticated sensors such as an AN/APG-81 active electronically scanned array (AESA) radar with air-to-air modes, plus advanced air-to-ground modes, including high resolution mapping, multiple ground moving target indication and track, combat identification, electronic warfare and ultra-high bandwidth communications.

In addition, the AN/AAQ-37 electro-optical distributed aperture system (DAS) is composed of six high-resolution infrared sensors strategically mounted around the F-35's airframe. These sensors provide unobstructed spherical coverage, enabling

An Israeli F-35I Adir assigned to 140 Squadron, Nevatim Air Base, taxis out for a mission during Red Flag-Nellis 23-2 at Nellis Air Force Base, Nevada, March 15, 2023 *William Lewis*

A USAF F-35 Lightning II assigned to the 65th Aggressor Squadron takes off for a Weapons School Integration (WSINT) mission from Nellis Air Force Base, Nevada *USAF/A1C Jennifer Nesbitt*

Two USAF F-35A Lightning IIs assigned to the 48th Fighter Wing rest at RAF Mildenhall *USAF/Senior Airman Sarah Spadie*

the system to detect and track missiles, including identifying launch points and cueing countermeasures. The DAS also enhances aircraft detection and tracking, offering infrared search and track (IRST) capabilities and supporting air-to-air weapon cueing to improve situational awareness. This system complements the AN/ASQ-239 (Barracuda), an advanced electronic warfare suite designed to provide self-defence against missile threats, enhance situational awareness and conduct electronic surveillance.

Finally, the electro-optical targeting system (EOTS) has a stealthy design. It works as a multi-function system that provides precision air-to-air and air-to-surface targeting capability and is linked to the aircraft's integrated central computer without the need for any external laser targeting and reconnaissance pods.

According to Lockheed Martin, the combat radius of the F-35 ranges between 450-600nm, depending on the variant and mission profile. The aircraft has a combined internal and external payload capacity of up to 18,000lb, which includes guided bombs and cruise missiles. These weapons are primarily designed for DEAD missions, rather than SEAD, which typically require anti-radiation missiles (ARMs). This distinction highlights the continued relevance of aircraft capable of deploying ARMs, such as the F-16CM, which remains a key platform for SEAD operations.

How this works

An authentic experience of how these jets were employed, related in an interview with Howard Altman for *The Warzone* website, came from an Israeli F-16I navigator: "We saw in the war against Iran the co-ordination between all the planes. Most of the F-35 missions were intelligence and provided valuable information that other planes like the F-16I don't have. They have a lot of equipment that helps them determine which missiles are heading towards us. And they can say to the F-16I: 'Be aware you're going to meet this kind of missile or another kind.' After we get this information, we do our attack mission, which is more precise. So what we do in our formation is let the F-35 go first, see what's going on, gather the intelligence and information and give it to us and the other planes, then we take this information and attack. I can't say specific things because they are classified, so I'm speaking in general."

Mike Mihajlovic commented: "The co-operation between F-35s and F-16s appears logical, particularly given the F-35's superior capabilities for operating in contested airspace. However, it is doubtful that the F-35s have been deployed in significant numbers in actual operations. Available information suggests that they have flown missions near the Iranian border, occasionally penetrating Iranian airspace to a limited and presumably safe extent to locate missile batteries."

Two F-35 Lightning IIs assigned to the 4th Fighter Squadron, Hill Air Force Base, Utah, alongside a KC-46A Pegasus assigned to the 22nd Air Refuelling Wing, McConnell Air Force Base, Kansas, during Exercise Bamboo Eagle 25-3 off the coast of California in 2025 *USAF/SSgt Tryphena Mayhugh*

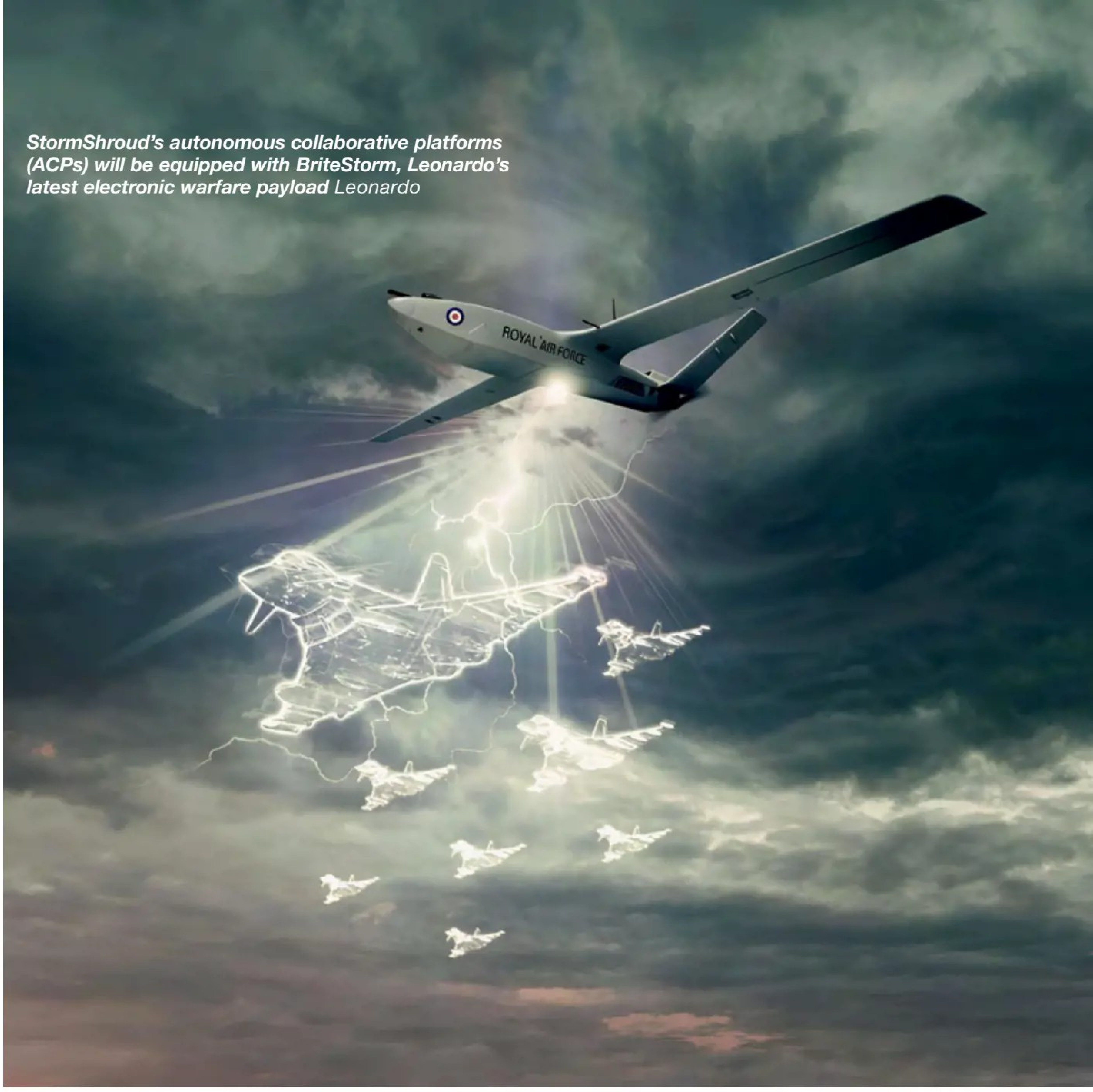
Through advanced data-sharing networks, the F-35s can either support conventional strike packages by relaying targeting data or engage targets directly. Nonetheless, the risks associated with the latter are considerably higher. Israeli doctrine seems to prioritise the preservation of its F-35 fleet, operating under a model that seeks to prevent any successful engagement by Iranian air defences.

The F-35's cautious approach to engaging air defence radar targets will not last much longer. In January 2024, the US Department of Defence (DoD) awarded Lockheed Martin a $97.3m contract modification to integrate AGM-88G high-speed anti-radiation missiles (HARMs) on the F-35A/B/C Block-4 TR3 aircraft. The AGM-88G will have a nearly 300km range and attack radars at more than Mach 2.5, using a sophisticated targeting system with passive radar homing, GPS/INS and active radar.

The US Navy has also employed smart munitions during its campaign in Yemen this year, including the GBU-53/B StormBreaker, using F-35C aircraft to target moving surface-to-air missile (SAM) systems. This precision-guided glide bomb is specifically designed to strike mobile targets in all weather conditions, making it highly effective in a dynamic SEAD/DEAD environment.

Futuristic lethal orchestra

Future variants of the F-35 will not solely be reliant on their capabilities to carry out these vital missions – missions without which the air campaign would collapse, as they are a core component of achieving air superiority



StormShroud's autonomous collaborative platforms (ACPs) will be equipped with BriteStorm, Leonardo's latest electronic warfare payload Leonardo

An F-35A Lightning II taxis down the flightline in a Beast Mode weapons configuration July 22, 2020, at Luke Air Force Base, Arizona USAF/ Staff Sgt Alexander Cook

and denying the adversary any defensive advantage. Efforts are currently underway to enhance the aircraft's effectiveness through complementary systems such as unmanned aerial platforms with a stand-in jammer payload.

During the Association of the US Army (AUSA) Exhibition 2024, Leonardo launched its new BriteStorm to be integrated and tested in army's air-launched effects (ALE) and future tactical uncrewed aircraft system (FTUAS) programmes, the USAF's collaborative combat aircraft (CCA) programme and the RAF's autonomous collaborative platform (ACP) strategy. Moreover, in May 2025, the RAF announced that its new StormShroud ACP will be equipped with BriteStorm. According to Leonardo, these systems will equip a fleet of Tekever AR3 small uncrewed air systems (UASs) that are entering service with the RAF to support the F-35 and Typhoon fleet.

The concept of these platforms will be revolutionary, being low in size and weight, easy to integrate onto attritable UASs and have a wide range of launched effects. At their core is an advanced miniature techniques generator (MTG), which, when paired with various transmit-receive modules and antennas, delivers stand-in jamming capabilities. These capabilities protect friendly forces from early warning, surveillance and target-tracking radars. They can also act as a decoy to stimulate enemy air defences and employ obscuration and confusion techniques to prevent the adversary from constructing a complete and accurate air picture. In addition, they automatically detect threat signals based on user-defined mission data, identify threats using measured signal parameters and select the appropriate countermeasures, which helps the system track threat system modes and adapt its countermeasure responses in real time. One of their best tactical benefits is their mission-reprogrammable nature, allowing rapid updates and optimisation against emerging threats.

These aerial platforms will be effortlessly controlled by F-35 pilots, like a maestro manipulating instruments, to deceive and disrupt enemy defence networks. Simultaneously, they will pave the way for the launch of AARGM anti-radiation missiles, which will reduce the number of combat units required for each mission and achieve optimal results with minimal risk to aircrews.

Undoubtedly, the F-35 is highly effective in the complex combat missions we witness today, thanks to its ability to perform a wide range of signal intelligence/reconnaissance tasks to support aerial formations in successfully executing offensive operations. However, its limited payload capacity and weapon variety remain a clear challenge to relying solely on its capabilities. That said, the aircraft's promising future enhancements make it a lethal aerial platform and position it as a key enabler for sixth-generation fighters – aircraft that are expected to guarantee air dominance across diverse combat theatres. afm

Six F-35 Lightning IIst follow closely behind a KC-135 Stratotanker aircraft over the Pacific Ocean on April 20, 2025 USAF/TSgt Andrew Stover

The S-400 quandary

Mike Mihajlovic considers the claims by both Pakistan and India related to the Indian Air Force's S-400 ground-based air defence systems

The S-400 Triumf (NATO name SA-21 Growler) formerly the S-300PMU-3, is a mobile long-range surface to air missile system. It's one of the most capable in the world and feared by most air forces that have to confront it *Images via author, unless stated*

India began inducting the S-400 Triumf system in late 2021, marking a significant enhancement of its long-range AD capabilities. Within a year, several regiments were deployed along the western front, with the first unit widely reported to be positioned in Punjab to monitor and secure airspace along the western border. By 2022–2023, additional units were operational, extending coverage to other strategically important sectors. The deployment was a clear signal of India's intent to strengthen its aerial deterrence posture, particularly against high-performance aircraft and long-range strike assets in neighbouring states.

The JF-17 officially entered service with the Pakistan Air Force in 2010. Initial production runs were completed in China, but as the program matured, manufacturing increasingly shifted to the Pakistan Aeronautical Complex (PAC) at Kamra, enabling domestic upgrades and greater autonomy over the fleet's configuration.

Among the most notable additions to the JF-17's arsenal was the CM-400AKG, a Chinese-made high-speed air-to-surface missile. Open-source evidence indicates that Pakistan likely acquired the CM-400AKG in the early 2010s, with integration and trials on the JF-17 beginning around 2012–2013. Since then, the CM-400AKG has been a central component of Pakistan's long-range strike capability. Its inclusion in the JF-17's armament portfolio expanded the PAF's ability to threaten heavily defended targets, both maritime and land-based, from standoff distances.

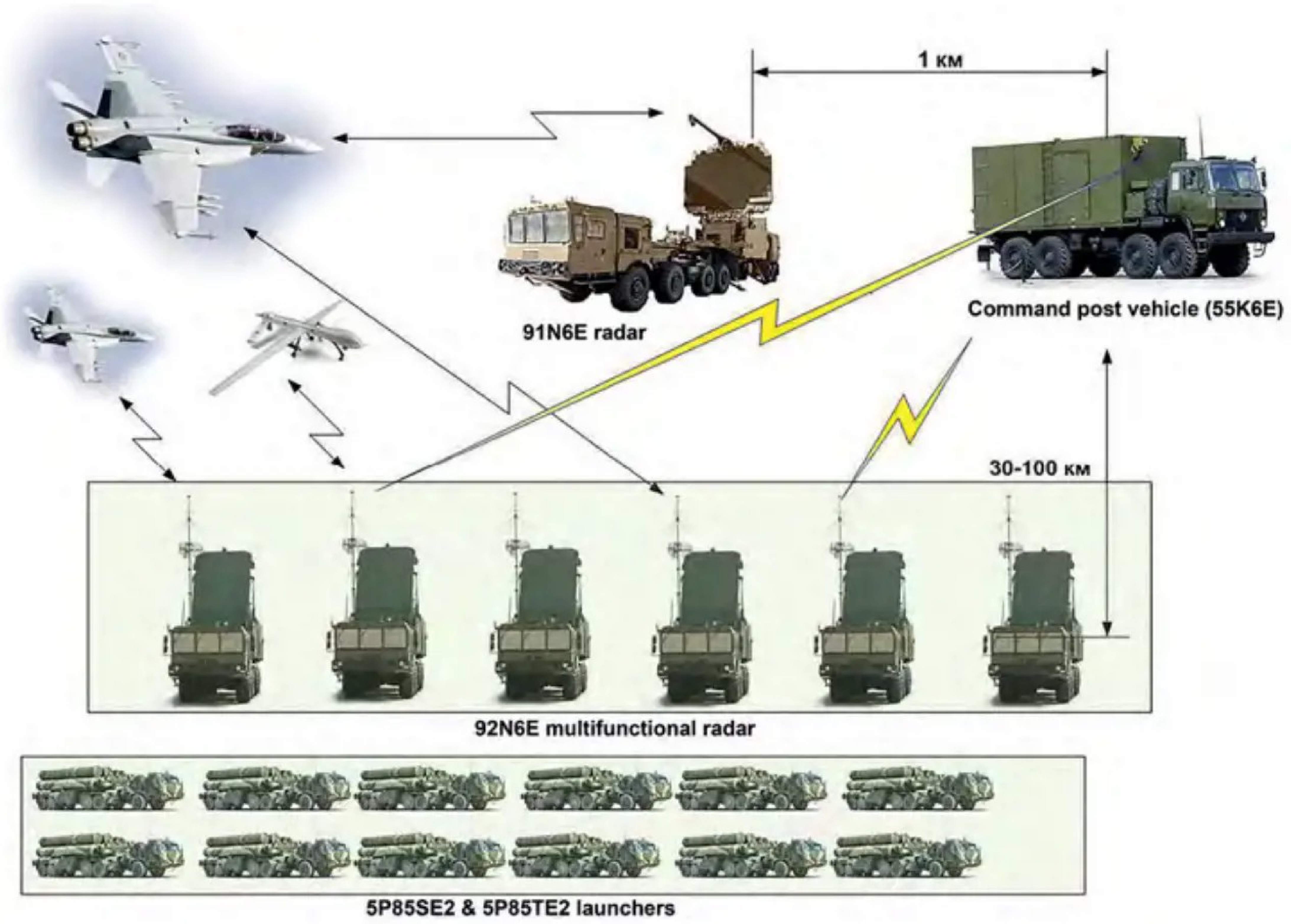
S-400

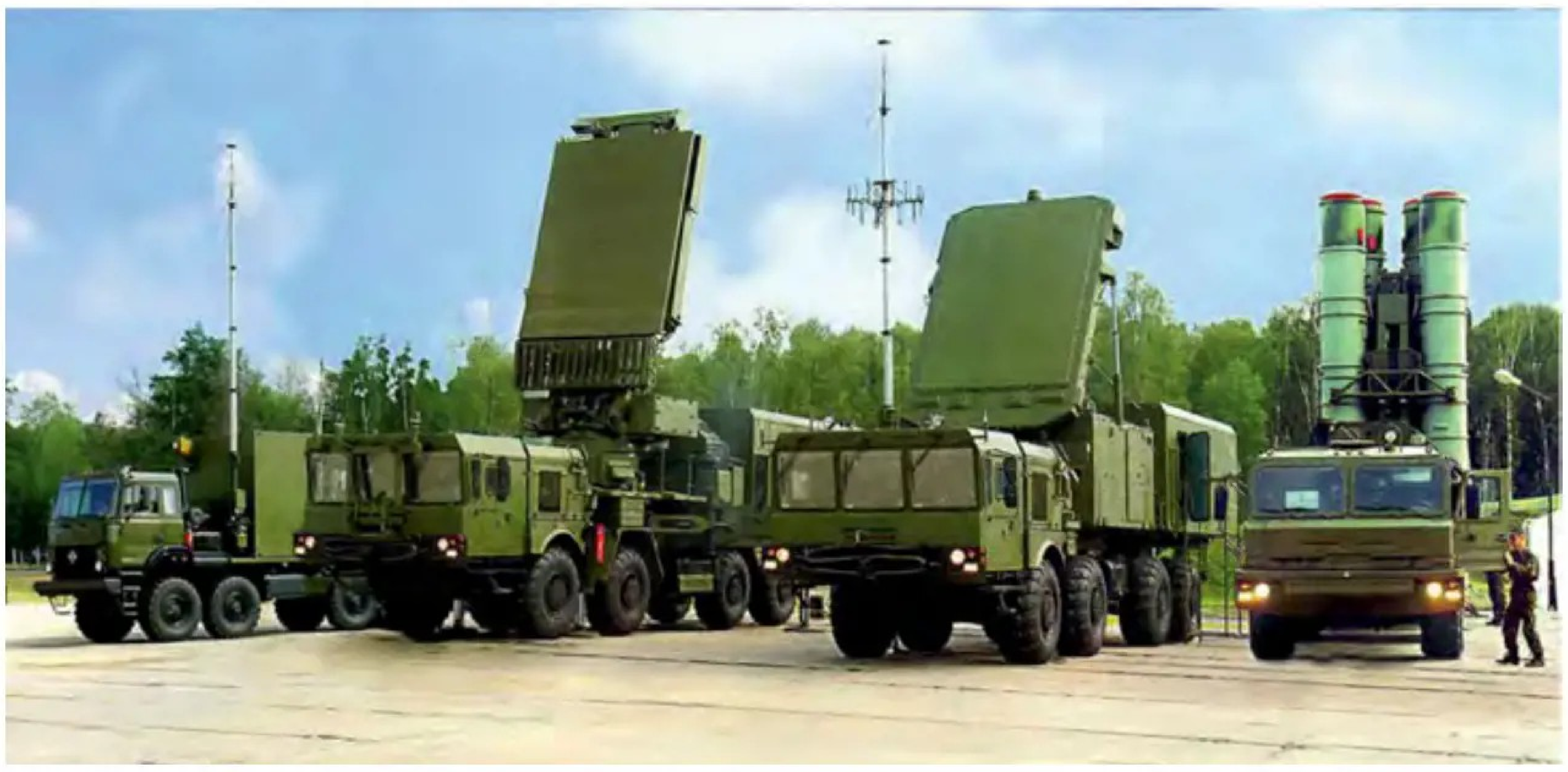
India's acquisition of the S-400 system represents a profound enhancement to its AD architecture, one that blends advanced radar capabilities, frequency agility, and networked resilience. At the heart of the system lies a suite of radar sensors: the 91N6E *Big Bird* for early warning and broad surveillance (over 300-600km), the 92N6E *Grave Stone* fire-control radar for engagement, the 96L6E *Cheese Board* low-altitude tracker, and optionally stealth-target detectors such as Nebo-M. These radars collectively create a layered detection envelope, enabling India to detect and begin tracking Pakistani aircraft from long ranges, irrespective of flight altitude or intent to evade.

The S-400 exists in two principal forms: the domestic configuration used by the Russian Aerospace Forces and the export configuration, which is designated by the addition of the suffix 'E' to component nomenclature, as in 91N6E for the acquisition radar or 92N6E for the engagement radar. While the export system retains the overall architecture, general capabilities, and versatility of the original design, it incorporates a series of deliberate modifications intended to protect sensitive Russian technology, maintain a strategic advantage over foreign operators, and comply with both national and international arms control regimes.

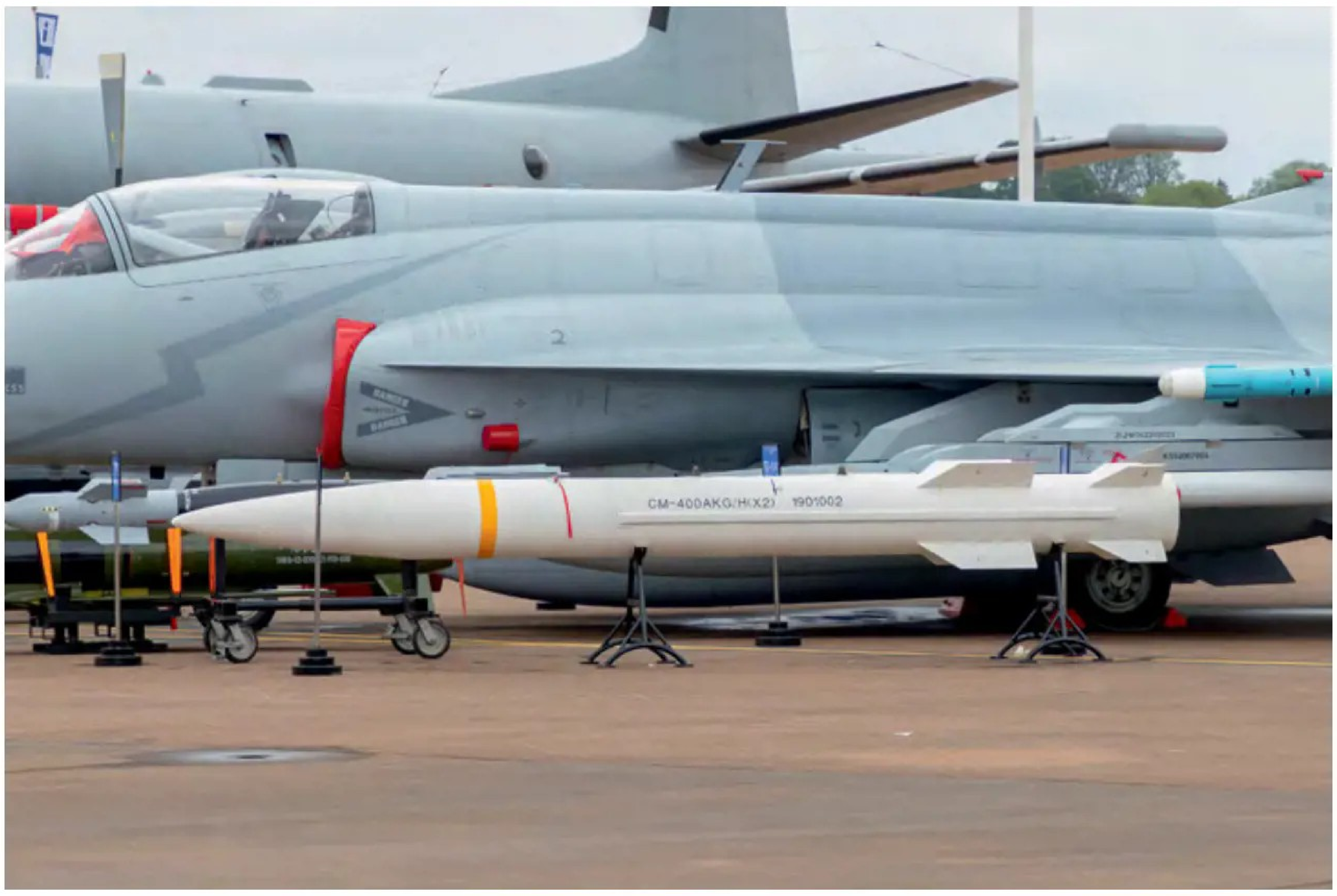
One of the most significant distinctions lies in radar performance. The domestic 91N6 acquisition radar has been credited, in ideal conditions, with the ability to detect large high-altitude targets at ranges approaching 600km. The export variant, the 91N6E, is slightly reduced in maximum detection range, often cited at approximately 570km, with a marginally lower effectiveness against targets with small radar cross-sections. The reduction in capability arises not only from moderated transmitter power output but also from the deliberate simplification of signal processing algorithms. A similar pattern is seen in the engagement radar. The Russian 92N6 radar can track over a hundred targets simultaneously and engage approximately forty of them at once, employing highly advanced target discrimination routines. The 92N6E generally retains most of this capacity, but in export form, its simultaneous tracking and engagement channels are slightly fewer, and certain adaptive discrimination functions are less sophisticated, limiting its peak efficiency in extremely dense or deceptive air combat environments.

The Russian domestic radars utilise a fully classified suite of counter-jamming features, including high-speed frequency hopping, wideband waveform agility, adaptive beamforming, and dynamic noise rejection algorithms. These allow the system to maintain target tracks even under concentrated hostile electronic attack. In the export versions, these features are retained in a functional but less complex form. Frequency agility remains a prominent characteristic, but the hopping patterns are simplified, and some of the adaptive ECCM (electronic counter-countermeasures) logic is reduced to make the system more predictable for authorised operators while safeguarding Russia's most advanced techniques from potential reverse engineering.

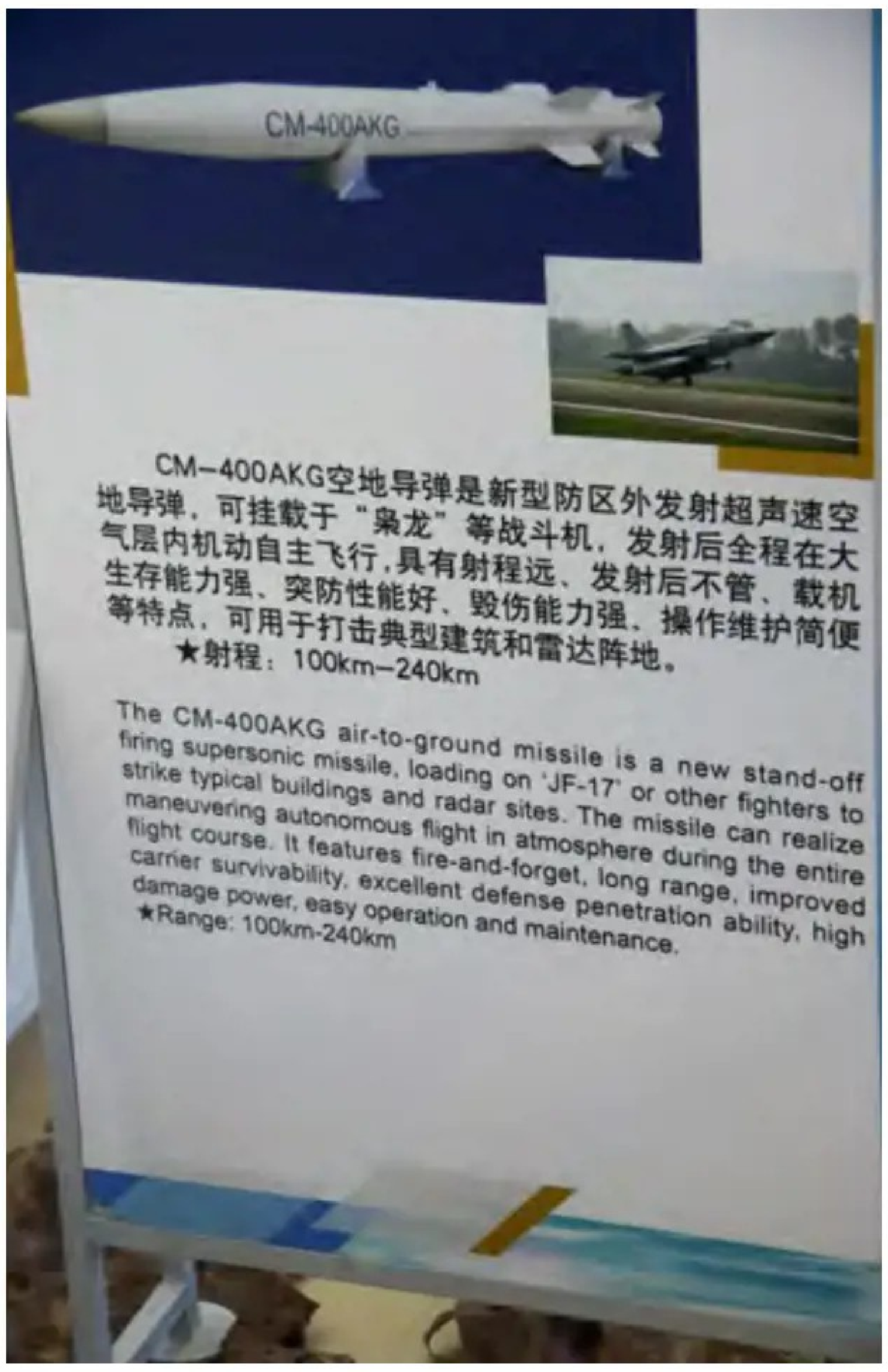

1 KM
91N6E radar
Command post vehicle (55K6E)
30-100 KM
92N6E multifunctional radar
5P85SE2 & 5P85TE2 launchers



The four mobile systems that make up the complete S-400 system. From left to right, the 55K6E Command post vehicle, 92N6E target acquisition radar, 91N6E surveillance radar and 5P85SE2/sP85TE2 missile launchers. The 91N6E Big Bang radar is usually parked about 1km from the command and control vehicle, while the 92N6E target acquisition radars can be found between 30-100km away



This mock-up of the big CM-400AKG was seen at the Royal International Air Tattoo in July, the weapon's first public viewing Chris Lofting



CM–400AKG空地导弹是新型防区外发射超声速空
地导弹，可挂载于“枭龙”等战斗机，发射后全程在大
气层内机动自主飞行，具有射程远、发射后不管、载机
生存能力强、突防性能好、毁伤能力强、操作维护简便
等特点，可用于打击典型建筑和雷达阵地。
★射程：100km–240km

The CM-400AKG air-to-ground missile is a new stand-off
firing supersonic missile, loading on 'JF-17' or other fighters to
strike typical buildings and radar sites. The missile can realize
maneuvering autonomous flight in atmosphere during the entire
flight course. It features fire-and-forget, long range, improved
carrier survivability, excellent defense penetration ability, high
damage power, easy operation and maintenance.
★Range: 100km-240km

The CM-400AKG information board displayed next to a mock-up at Zhuhai Airshow in 2019
Alan Warnes

A JF-17C Block 3 Thunder launched the CM-400AKG missile at the IAF's deadly S-400 air defence system. Two members of 14 Squadron 'Tail Choppers' were awarded the third highest military honour, Sitara-i-Jurat (Star of Courage) for their part in the mission *Alan Warnes*

The PAF claims it destroyed an IAF mobile 91N6E (NATO name Big Bird) acquisition radar with a CM-400AKG missile that was launched from a 14 Sqn JF-17C Thunder on May 10

The differences extend beyond the radar subsystems to the missile inventory. The Russian S-400 employs a family of missiles including the 40N6, with a reported range of up to 400km; the 48N6DM, with a range of 250km; and the 9M96E/E2, which are shorter-range but highly agile interceptors. While export clients may receive the 40N6E missile with a nominally similar maximum range, its seeker sensitivity, ECCM robustness, and in some cases actual operational range are thought to be marginally reduced compared to the domestic missile.

A remarkable facet of the S-400's design is its use of frequency-hopping and beam-steering technologies. These features allow the radar to rapidly switch frequencies in a pseudo-random manner and direct energy precisely toward targets – techniques that severely degrade the effectiveness of enemy jamming attempts. In practice, such agility forces an adversary's jammer to spread its power across multiple frequencies or attempt to predict the hopping sequence, often unsuccessfully, thus substantially weakening any jamming effort.

India's deployment of the S-400 goes beyond standalone operation; it is deeply interwoven into the nation's broader defense sensor network. Systems such as the indigenous Akash AD and Rajendra radar are integrated via the IACCS command-and-control system, helping to correlate radar data from various layers and maintain tracking even amidst jamming or signal interference. The Rajendra, a passive phased-array radar, can track multiple targets and issue missile guidance commands, even under intense electronic warfare conditions.

This combination empowers the S-400 not only to detect, track, and lock onto Pakistani aircraft, whether traditional fighter jets, surveillance platforms, or low-flying drones, but also to maintain that capability when adversaries attempt to blind it electronically. Indeed, analysts note that during past operations, including instances like the recent Operation Sindoor, the S-400 demonstrated a robust ability to maintain target locks under jamming pressure.

It is also important to note that the S-400's anti-electronic warfare (EW) capabilities extend beyond pure hardware and software design. Russian doctrine emphasizes mobility and concealment for its high-value air defense assets. The S-400 launchers, radars, and command posts are mounted on mobile platforms that can be rapidly redeployed. Frequent movement, combined with decoys and emission control techniques, makes it harder for adversaries to concentrate jamming efforts against a fixed position.

The result is a layered defense against EW: multi-band radar redundancy, signal processing that filters interference, networked sensors providing independent target data, guidance systems that are less dependent on continuous external input, and operational tactics that minimize vulnerability windows. While no system is entirely immune to the effects of advanced jamming – particularly from well-resourced adversaries – the S-400's combination of technical features and operational doctrine makes it considerably more resistant to EW suppression than many of its peers.

The takeaway is that the S-400's resistance to electronic warfare is not due to a single 'magic' technology but to an entire philosophy of redundancy, adaptability, and integration. In a future battlefield where electronic attacks will be as common as missile salvos, the S-400's designers have built a system intended not merely to survive under electronic assault, but to continue fighting effectively even when the electromagnetic spectrum is heavily contested.

Moreover, its missiles are capable of engaging high-speed threats and executing high-precision interception. The 9M96E2, for example, can maneuver up to 20g and achieve Mach speeds that make low-flying targets vulnerable, even those just five meters above ground level. The system's missiles can also intercept ballistic and cruise missiles and are claimed to possess anti-stealth capabilities when used in concert with suitable radar nodes.

Pakistani CM-400AKG

In its standard configuration, the CM-400AKG can reach speeds between Mach 4.5 and Mach 5.5 during the terminal phase of its flight, which significantly reduces the window for interception and complicates defensive response. Its operational range is generally reported to be up to approximately 250km, though the actual reach can vary depending on factors such as launch altitude, aircraft speed, and specific mission profile. The PAF claims 400km. The missile utilises an inertial navigation system supplemented by satellite navigation inputs for mid-course guidance, and it can engage precision targets in the terminal phase using either radar or infrared seekers. The warhead configuration typically includes a 150kg high-explosive fragmentation variant, or a heavier penetration model intended for use against fortified or hardened targets.

The CM-400AKG's flight trajectory tends to combine a high-altitude cruise with a steep terminal dive, a manoeuvre designed to reduce the effectiveness of point-defence interceptors and complicate radar tracking. These flight characteristics, combined with its substantial warhead, give the missile a broad engagement envelope and allow it to threaten a diverse range of targets, including static infrastructure, command posts, and mobile air-defense systems. Its high speed and maneuverability, coupled with flexible guidance and destructive payloads, make it a formidable ordnance capable of penetrating sophisticated defensive networks and imposing significant operational risks on adversary air-defense platforms.

Confrontation

According to India's air chief (see page 56), the sharpest use of the S-400 came during clashes in May 2025's Operation Sindoor. He stated that Indian air defences shot down six Pakistani jets - five fighters and one large aircraft - adding that "most" of the kills were by S-400 and that the large aircraft (described as a surveillance-type) was engaged at roughly 300km range. He offered no evidence.

Pakistan immediately rejected this account, calling the Indian narrative "fabricated". A very different headline was that Pakistan destroyed an Indian S-400 battery at Adampur in Punjab (see page 56). Pakistani media and social channels framed this as a precision strike, sometimes pairing the claim with footage of a JF-17 carrying CM-400AKG missiles. India formally dismissed these stories as fake via the government's Press Information Bureau fact-check, and Indian outlets highlighted a subsequent prime-ministerial photo-op in front of an S-400 at the same base as a rebuttal.

The core problem is evidence: Pakistan has not released corroborated damage imagery of a destroyed battery, and India has not provided independent audit trails for all of its own claims either. In short, the destruction claim remains unverified propaganda to New Delhi, and a victory claim to Islamabad.

S-400 vs CM-400AKG

A confrontation between these two systems would revolve around the CM-400AKG's claimed ability to penetrate or evade the S-400's defensive envelope. One possible scenario involves Pakistan launching the missile at or near its maximum effective range. By exploiting the missile's speed, high flight path, and steep terminal dive, Pakistani planners might have aimed to compress the S-400's reaction time and reduce interception probability. In such an attack, the CM-400AKG could be guided towards key components of the S-400 battery, such as its command post or its radar units, potentially limiting the system's effectiveness even without destroying its missile launchers. For more see page 56.

Such an operation would closely resemble a SEAD mission, although the CM-400AKG is not inherently an anti-radiation missile. In theory, if the missile were equipped with a passive seeker or supplied with precise targeting data, it could be directed towards the radar emissions of an S-400 battery, potentially threatening its most critical sensing components. The notion of "hoping to extend the range" does not necessarily imply exceeding the missile's technical limitations. Rather, it reflects a tactical decision to operate the CM-400AKG near the upper boundary of its performance envelope, thereby maximising standoff distance to keep the launching JF-17 relatively safe while attempting to strike high-value targets deep within Indian airspace.

However, the CM-400AKG faces inherent limitations related to fuel capacity and flight endurance. Extending its range requires that the JF-17 reach higher launch altitudes to optimise trajectory and maximise the missile's glide and cruise phases. This approach, however, increases detectability, as Indian S-400 radars would likely acquire the launch platform as it climbs, providing early warning to the air-defence crews. Once the missile is launched, its trajectory is similarly observable, granting the S-400 operators precious extra seconds to initiate countermeasures, prepare interceptors, or activate electronic counter-countermeasures. In essence, while the CM-400AKG offers high-speed, stand-off strike potential, the interplay between launch altitude, missile range, radar detection, and defensive reaction times imposes a complex operational calculus that both sides must consider in planning such high-stakes engagements.

Regardless of the veracity of these claims, the event illustrates the strategic interplay between advanced strike systems and cutting-edge air defence networks in South Asia. Pakistan's adoption of the CM-400AKG provides it with a high-speed, stand-off strike capability that complicates India's threat calculations. Conversely, India's deployment of the S-400 creates a defensive barrier that forces Pakistan to consider long-range, high-risk tactics if it wishes to threaten critical assets. The 2025 episode, whether successful or not, underscores that modern conflicts in the region are fought as much through contested narratives and psychological deterrence as through physical destruction. Each side seeks to demonstrate both capability and resolve, while carefully managing escalation risks in an environment where technology, strategy, and information warfare are closely intertwined.

One thing is certain: without hard evidence, such as on-site photographs, authenticated radar recordings, and thorough parametric analysis, what truly occurred between these two systems remains, for the time being, a matter of speculation and personal interpretation. Both sides have relied heavily on their own preferred narratives, often presenting them as established facts. In this sense, the situation resembles the evolution of the Ghost of Kyiv story, which began as a mixture of rumour and propaganda before gradually taking on new shapes and layers, moulded as much by perception and politics as by verifiable reality. In the absence of incontrovertible proof, such accounts tend to live in a space where strategic messaging, national pride, and the public's appetite for dramatic stories all converge, making them resistant to definitive resolution.

For more on this topic see *Understanding the Rafale kills*, p43-58 **afm**

A 96L6E (NATO name: Cheese Board) a 3D early-warning and acquisition radar was also successfully targeted by a PAF JF-17C according to the PAF. It scans a specified area and automatically generates a target flight path for priority targets

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The Hornet and the Gulf War
Part 3: US Marines ashore
Canadian Hornets in Germany

Although it lost out to the F-16 in the USAF Light Weight Fighter Competition of the 1970s, Northrop's then YF-17 was redesigned to become the F/A-18 Hornet, first flying in 1978.

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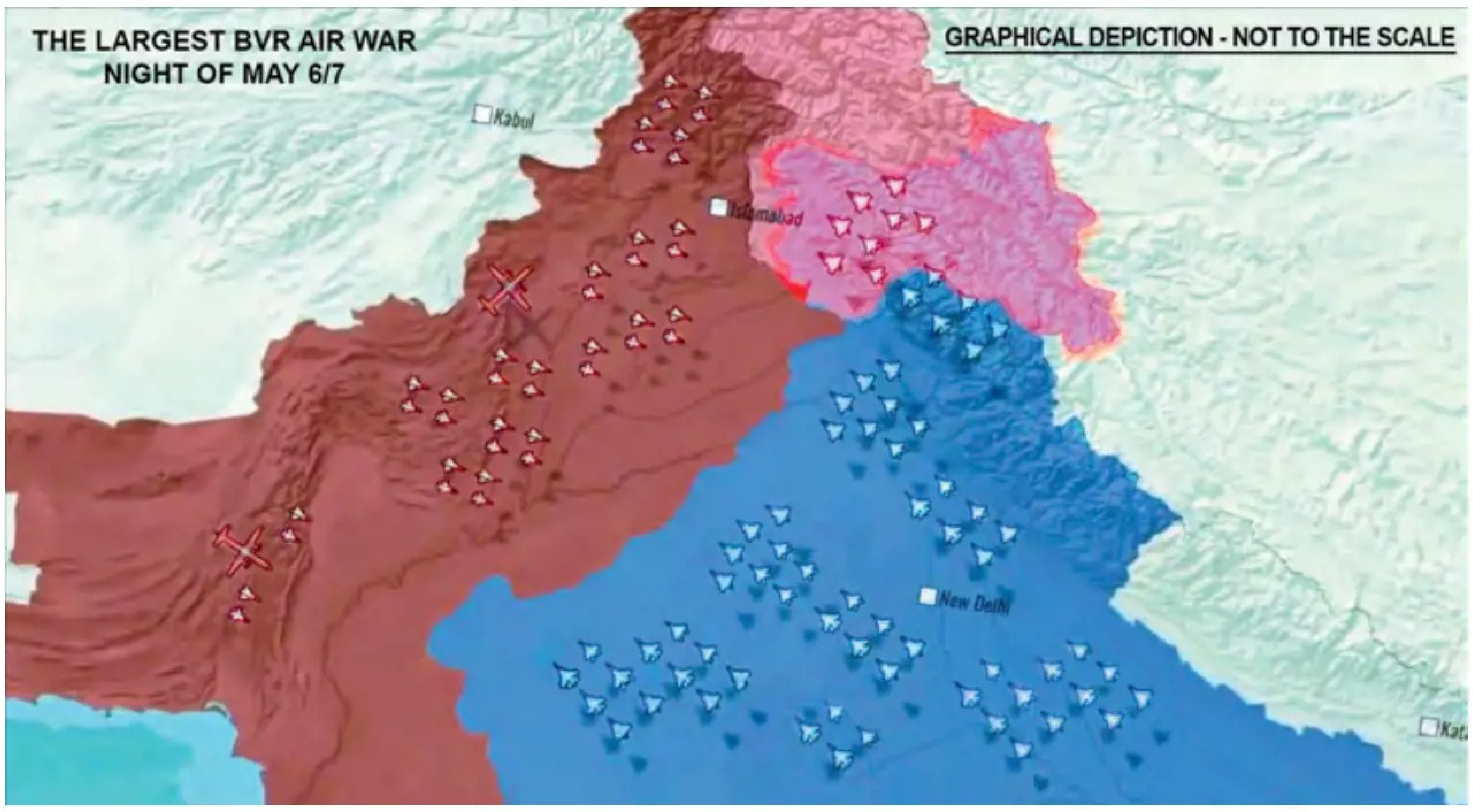
Understanding the Rafale kills

Alan Warnes gained rare and exclusive access to the Pakistan Air Force in mid-July, to understand how it managed to shoot down six Indian Air Force fighters on the night of May 6/7

With vapour streaming from its wing tips, this camouflaged Chengdu J-10C looks every inch the deadly fighter it was on May 6/7 All images Alan Warnes unless stated

PAF Commander, ACM Zaher Ahmed Baber Sidhu has revolutionised the PAF over the past four years. PAF



On May 6/7 the two air forces faced off, looking across their borders in formations like this PAF

"We ambushed them," a high-ranking PAF officer told me in mid-July. "We trapped them in our kill chain and created chaos."

That's how the PAF claims it shot down six Indian Air Force (IAF) fighters in the early hours of May 7, when the biggest beyond visual range (BVR) air battle was contested on Pakistan's border with India.

The IAF had launched Operation Sindoor (Sindoor being an orange/red powder worn by Hindu women). The PAF retaliated with a counter-operation, Operation Bunyan-un-Marsoos, (an Arabic phrase meaning a solid structure, derived from the Quran.)

More than 114 fighters were involved - 72 IAF and 42 from the PAF - most believed to be fitted with BVR missiles developed by the French, Israelis, Russians and Chinese.

The senior officer said: "Fifty-two minutes after the air war had started, the fight was over, we won and they headed home.

"We could have shot down more Rafales than we did, but we held back. An escalation could have led to all-out war between two nuclear nations. During Op Bunyan-un-Marsoos we targeted the Rafales and the S-400s [Russian air defence system] and it worked out well!"

Unfolding air war

India had been seeking revenge for the Pahalgam terror attack that took place in Indian-administered Kashmir on April 22, when five armed terrorists killed 26 mainly Hindu civilians. India's government, led by Prime Minister Narendra Modi, blamed Pakistan for this atrocity and he, along with the majority of the Indian public seemingly, wanted revenge.

"We watched while on full alert, waiting for a response," the PAF officer told me. For six tense days, the PAF monitored the build-up of transport aircraft, supporting large deployments of fighters to several IAF Western Command and South-Western Command bases. They knew an attack was imminent and were prepared for it.

Each of the four Air Commands – North, Central, South and West – operates deployable command and control (C2) centres, capable of directing operations across vast distances. Among their many functions one stood out for the author - the long-range vectoring of hypersonic missiles, like the CM-400AKGs that the PAF JF-17C Thunder jets launched at some of the most formidable assets in India's arsenal. They included the highly advanced Russian-built S-400 air defence systems (see *The S-400 Quandary*, pages 38-41).

The author was granted rare access to one of the deployable C2 centres, witnessing first-hand how it functioned. It is part of the PAF

MULTI DOMAIN PAF SPACE FORCE
UNTER SPACE OPS (SATCOM)
OPEN SOURCE PROFILING SYSTEM
REGIONAL ENVIRONMENT

The PAF Commander's inner circle in the wake of the air battle with the IAF on May 7. This is the Multi Domain Ops room, where all the data was fed in from different sensors PAF

The PAF Commander, ACM Zaheer Ahmed Baber Sidhu in the National ISR and Integrated Air Ops Center (NIIACC) during Op Bunyan-un-Marsoos PAF

Chief of the Air Staff, Air Chief Marshal Zaheer Ahmed Baber Sidhu's integrated multi-domain operations philosophy he has pursued since becoming PAF Commander in March 2021 – for more on that see later. An Air Vice Marshal from the newly created Space Force added: "The C2 centres are reliable and robust and can see across the border into India, but I won't disclose the range due to the sensitive nature. Fusing data with our new unmanned, space, EW and cyber commands means they are effectively our nerve centres."

PAF's Space Command has redefined the battlespace. Using indigenous satellites, it delivers round-the-clock intelligence, surveillance and reconnaissance (ISR) support. The Global Navigation Satellite System (GNSS), datalinks real-time information to PAF aircraft bypassing the limitations of the line-of-sight communication. Through secure SATCOM connectivity, pilots not only gain unmatched situational awareness but also offensive capabilities like electronic attack. It's a central piece of the PAF's Link 17 (and the enhanced Skyguard system), fed to the JF-17s, J-10Cs and Erieye to provide pilots with the situational awareness needed to win a war.

This means every cockpit receives a Recognised Air Picture through encrypted datalinks, ensuring PAF aircrew possess the tactical clarity needed to dominate the skies. This fusion of space, cyber, electronic warfare (EW) and kinetic power has turned the PAF into a truly multi-domain combat force, capable of deterring, responding and prevailing in future wars, which seems highly likely. This capability has been built up since the author's last visit in 2020 and was clearly revolutionising the way PAF the trains and goes to war.

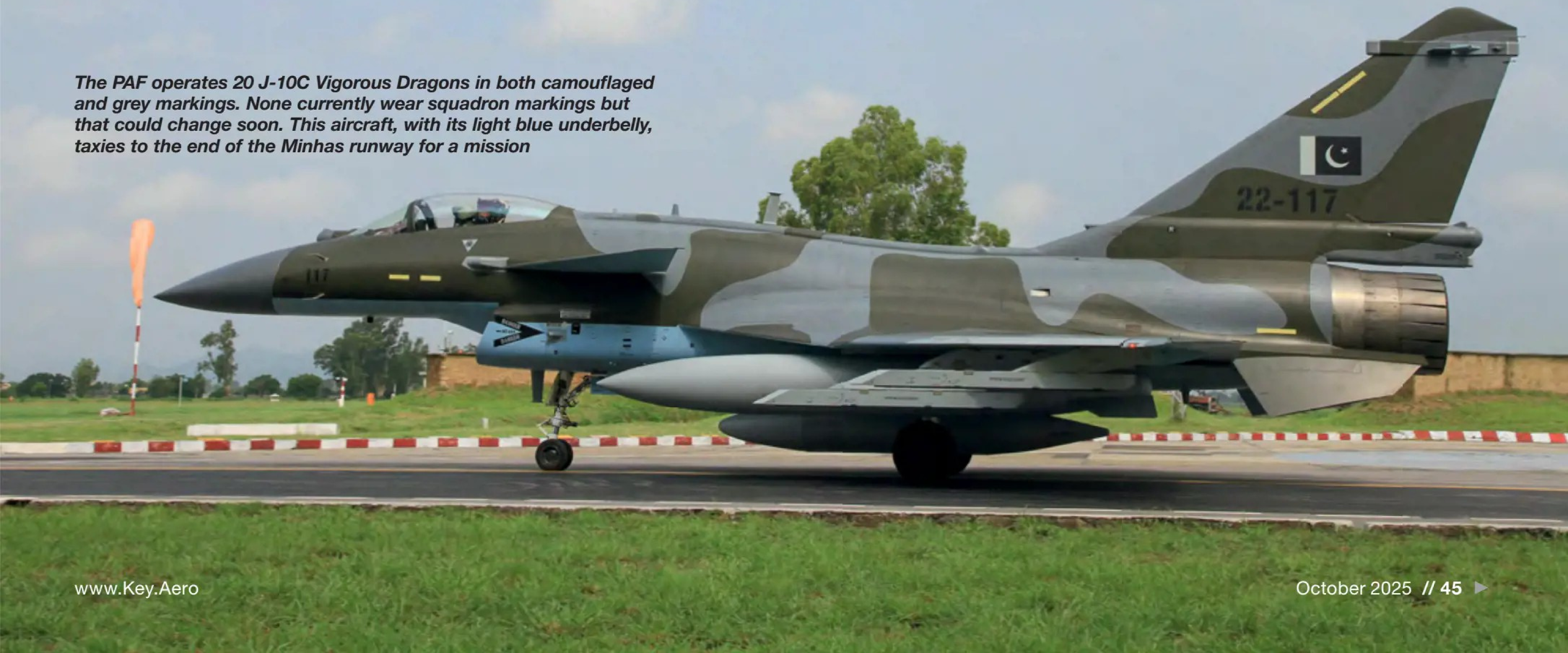
Several military veterans the author spoke to were keen to stress that the PAF is just part of the fighting machine run by the Chief of Army Staff, Field Marshal Asim Munir who made a high-profile visit to the USA in mid-August. He harnesses the combined strengths of Army, Navy and Air Force, but this feature focusses on the PAF.

EW at work

On April 29, a week after the Pahalgam attack, four IAF Rafales departed Ambala Air Force Station. Their mission, to bomb terrorist targets in the north, but according to the PAF, a mobile PAF electronic warfare (EW) unit deployed

AEROSPACE POWER CENTRE OF EXCELLENCE
MUSHAF
ACE

All new air doctrine is created and tested at the PAF's ACE facility, based at Mushaf, that has a huge tactical training range - one of the best in the world according to the Turkish Air Force (see last month's Anatolian Eagle exercise report)



The PAF operates 20 J-10C Vigorous Dragons in both camouflaged and grey markings. None currently wear squadron markings but that could change soon. This aircraft, with its light blue underbelly, taxies to the end of the Minhas runway for a mission

A grey J-10C with six hard-points under the wings, two equipped with twin missile racks. During the author's time at Minhas, a grey example always flew with a camouflaged jet

along the front line saw them approaching and jammed their radars and communications, while cyber-attacks on electric grids in the north, rendered the Rafales helpless. They abandoned their mission and instead diverted to Srinagar Air Force Station.

The Dassault 20ECMs of 24 'Blinders' Squadron which had performed so well in Op Swift Retort in February 2019 (see panel) were not used in Operation Bunyan-un-Marsoos because of their lack in wattage power. Trying to overpower a target receiver is heavily influenced by the power output, and a lack of this power will make the jammer less effective at disrupting intended signals. This would have been the case with the S-400 air defence system or Rafale's Thales RBE2 radar, which MBDA designed to be robust against jamming, and integrated with the passive Thales Spectra EW system.

The EW mobile units designed by the new NASTP (National Aerospace Science & Technology Park) in recent years, instigated by the PAF's Commander, ACM Sidhu, were being fielded at various locations to jam targets. Between April 29, when the IAF tried their failed attack, and May 6, the PAF had watched the IAF deploy up to 20 Rafales from Hashimara (home of 101 Sqn in the Eastern Command) to Gwalior and several other bases (Ambala, home of 17 Sqn Rafales in Western Command, Srinagar and Bikaner/Nal in Rajasthan). Several S-400 *SA-21 Growler* surface-to-air missile batteries were moved to Adampur, Bhuj and Bikaner.

The IAF mobilised around 400 aircraft in late April and early May, with the transport fleet flying over 500 sorties, obviously to move around weapons, logistics and personnel for an attack. The PAF was prepared.

At 1230hrs on May 7, that attack came

Three J-10C flying line abreast armed with 18 air-to-air missiles between them. The Chinese People's Liberation Army Air Force is now keen to understand how the PAF worked their jets so well operationally

> *"We could not let the attack go unpunished. No one infringes Pakistani sovereign territory, and we are entrusted to protect it."*

ACM Sidhu has boosted the PAF's capabilities considerably with his operational and industry visions. He is seen here walking to a F-16 alongside members of his staff and base personnel PAF

when the IAF bombed nine sites in Pakistan with long-range Spice 2000 precision-guided bombs. The CAS immediately changed the rules of engagement, with airborne PAF fighters instructed to move from defensive to offensive mode. He spoke directly to all the PAF pilots in the air via radio, commanding them to shoot them down, and according to several sources he told the airborne fighter pilots: "Kill them, kill them, don't let them enter even an inch into Pakistan."

The PAF could not let the attack go unpunished, and as the spokesman told me: "No one infringes Pakistani sovereign territory - we are entrusted to protect it.

"When the IAF released those bombs, there were already 72 IAF aircraft in the air, as their numbers had steadily increased. We started the attack on the different strike packages of Rafales, Su-30MKIs and Mirage 2000s."

Most of the IAF's 36 Rafales were flying in offensive mode on the Indian side of the border at some point and according to the PAF, they were equipped with MBDA's highly capable Meteor BVRAAM, backed up by Su-30MKI *Flankers* armed with Israeli Derby BVR missiles and Spice 2000 precision-guided munitions (PGMs).

According to the ISPR (Inter Services Public Relations) press briefing on May 7, the IAF had eight formations lined up along the eastern border, each strike package comprised eight aircraft: four Su-30MKIs, two Rafales and two Mirage 2000s.

Locking on the target

A senior PAF pilot explained how they prepare for war with India, always a real possibility. "It's in the training," he said. "Going to theatre, the fighter's radar cannot see all the targets as they are too far away, but the Saab 2000 Erieye does."

As a high value asset and undoubtedly a target for India, the Saab 2000 Erieye will keep out of harm's way flying close to the western border, over 400km (250 miles) from India.

He continued: "The operator sitting in front of his screen in the Erieye will label the enemy aircraft into the different groups and assign them to the PAF packages. This will be done in groups of three or four aircraft according to azimuth and altitude, then the operator assesses and relays [the positions] to all the aircraft, but he will still control them.

"The war picture is built through Link 17/ Skyguard, which we see on the displays in our cockpit, and the aircraft we are assigned to shoot – which we term 'the contract'. The Air Boss and his team [in the Multi Domain Ops Room] will also be looking over the scene on a massive screen in AHQ.

"The fighter pilots have two radios in the cockpit, one to discuss the complete aerial picture and another to talk to members in your formation.

"If I am targeting their no 1 and 2, I would see them on my scope, put my cursor on them and lock my missiles onto them.

"My radar is then locked onto the target and

With its front wheel lifting off the runway, this J-10C is set for another mission

TACTICS DEVELOPMENT SCHOOL
KNOWLEDGE - INNOVATION
PROFESSIONALISM

The Tactics Developments School is where the anti-Rafale ops are rolled out to PAF personnel. The PAF has always worked harder to define tactics against its Indian foe and no stone is left unturned to ensure that they are successful

is linking info to the missile until a certain range, when the missile switches on to its own AESA [Active Electronically Scanned Array] seeker within the PL-15's minimum abort range [MAR]."

The MAR is the closest an engaging aircraft can get to the target and fire the missile before getting out of a fight, before the missile threat is able to run you down.

"Once your missile's active range (in this case the PL-15) is met, you can turn back (to ensure you don't fly inside the MAR of a Meteor -let's say 35 miles). The missile with its AESA seeker will then lock on to target and shoot it down."

The author was told the Rafale pilots would not have known what hit them until the PL-15Es were about three seconds out.

"Remember, if you miss your designated aircraft, it could get you. We train continuously for this. A mission of 15 minutes can regularly take up to eight hours to debrief!

"In a war theatre you can put as many aircraft as possible up. The IAF sent 72 into the AOR [Area of Responsibility] but it's a lot for the GCIs [Ground Control Interceptors] to control!"

One of the lessons the IAF must have learnt from that night was the sheer number of aircraft they deployed in the air was too much to handle. Each IAF GCI would have to manage several aircraft in an extremely dynamic situation, particularly as aircraft were being shot down. The PAF Commander said: "We designated an IAF aircraft for every J-10 or JF-17 Block 3 with the battle space being managed much better because of the multi domain ops."

Going for the kill

Waiting for the IAF fighters to make their move in the early hours of May 7 were PAF J-10C Vigorous Dragons and JF-17C Thunders, both armed with Chinese PL-15s (CH-AA-10 *Abaddon*) BVRAAMs and shorter-range PL-10s (CH-AA-9 *Azrael*). Behind them were F-16C Block 52s with the shorter range AN/APG-68 radars, equipped with AIM-120C AMRAAMs (Advanced Medium Range Air to Air Missiles).

Highly capable and well-trained pilots from both sides were going into battle with an immense amount of national pride at stake.

As they raced towards each other and the missiles of the Indian fighters went 'hot', the PAF Commander gave the order from the NAIIOC (National ISR Air Ops Centre) to break their data links, which meant they would lose all situational awareness. Jamming from mobile EW units dotted all along the eastern fringes of Pakistan completed the damage.

The Rafale's cutting edge Thales Spectra integrated electronic warfare system was designed to protect the Indian Air Force's jet. The pilot should have been warned by Spectra that something was watching them, and they needed to start taking evasive action. Spectra should have detected the radar of the enemy aircraft's electromagnetic waves. Unless of course the J-10 did not switch on its radar, and the target information was data linked to the fighter that then fired the PL-15. When the missile eventually switched on its AESA seeker in the terminal phase, it would have been too late for the Rafale.

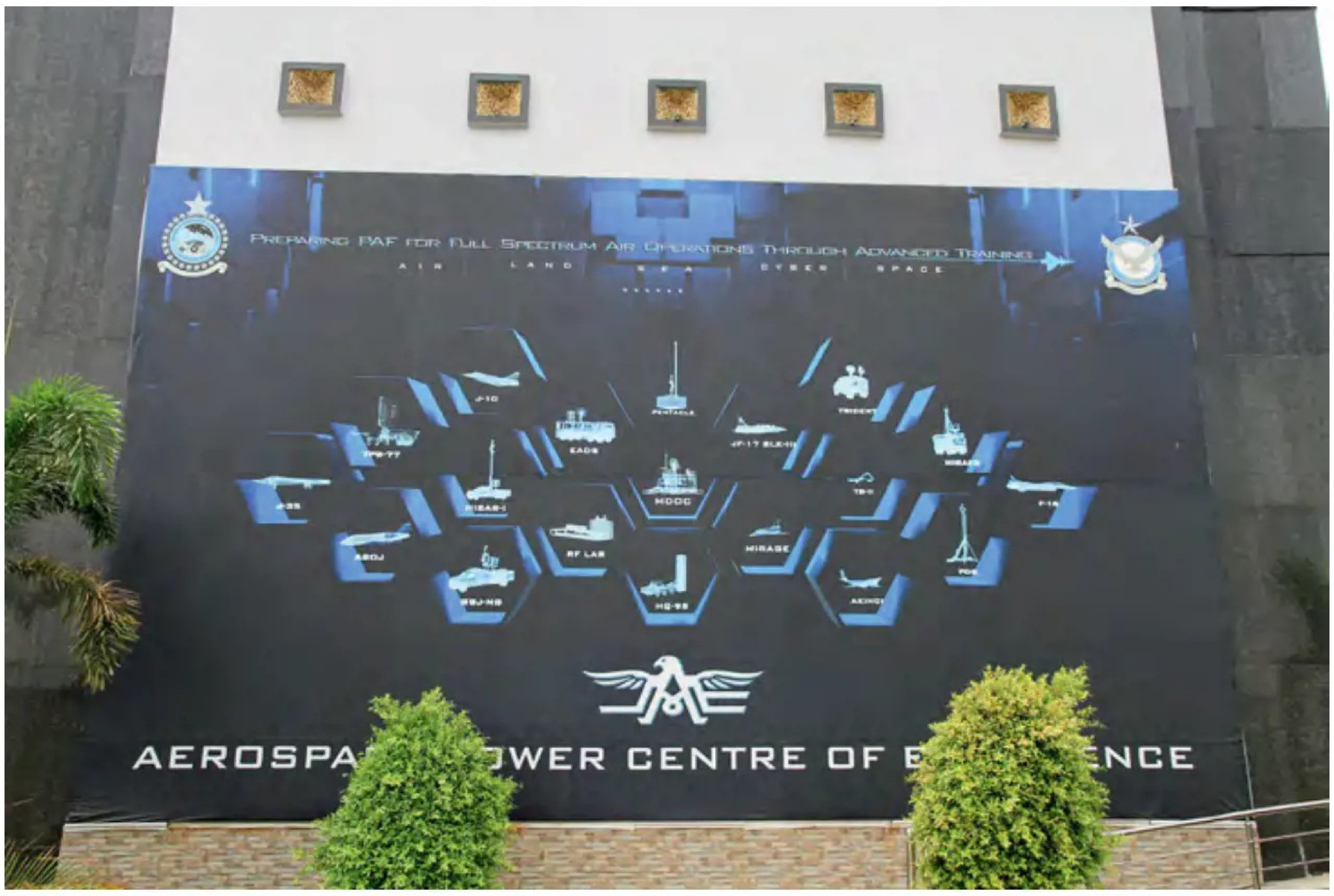
In the Ops room, the PAF Commander instructed a pilot to fire at their selected adversary, visible on the Comprehensive Complete Air Picture (CCAP) screen. The author was shown a recording of a PL-15E leaving the J-10's missile rail and tracking towards the red target. Once the target was hit, the signal would blink intermittently, until it disappeared. All the information on the targets was available to the PAF.

As one retired officer stated: "They were sitting ducks - they didn't stand a chance when our J-10Cs unleashed those PL-15s. Our Multi Domain Ops ensured the IAF pilots couldn't perform in the air battle."

The radar range of both the J-10C's KLJ-10 and the Rafale's RBE2 is believed to be around 200km (125 miles). According to the PAF, not one Meteor was fired at the PAF fighters. The PL-15Es hit their targets at between 160 and 190km (100 and 120 miles) out (close to the maximum kinetic range of the export version of PL-15), and with the Meteor's range only being about 150km, you can understand why. The PL-15E had an edge of about 40-50km and the IAF fighters were downed over Indian territory. The PL-15 is certainly faster than the Meteor so that would be another factor. The PAF effectively trapped the IAF pilots in their 'kill chain'.

Three of the IAF's satellites were by now under PAF control, using its indigenously developed systems. The downlinks were subsequently severed and the GPS signals were neutralised. At the same time, the PAF's cyber warriors launched a sweeping offensive, crippling 96%

Indian Air Force losses
4 x Rafale EH
1 x Su-30MKI
1 x MiG-29UPG
1 x Mirage 2000H
1 x Heron Mk2



Preparing the PAF for Full Spectrum Air Ops, the Aerospace Power Centre of Excellence has all the elements of the PAF offensive force. The J-35 and ASOJ (Airborne Stand Off Jammer) are both listed. While ASOJ has been contracted with Turkey, the J-35 is still being studied

PAKISTAN AIR FORCE
اژدر شعلہ فشاں
NO15 MR SQUADRON

A J-10C sits on the edge of the 15 (Multi Role) Squadron shelter area, armed and looking very dangerous. Clearly visible is the IRST sensor on the nose and the air-to-air refuelling probe *PAF*

of India's social networks, penetrating critical systems, and even disrupting the country's railways, airlines, banks and energy grids to sow chaos. Bold messages flashed across Indian CCTV screens, while websites were defaced and key digital nodes were struck, triggering electricity blackouts across vast regions of India. This was the first time any Air Force in the world had synced its cyber operations with its kinetic operations.

PAF Cyber Ops had shifted into offensive mode. Back in 2019 during Operation Swift Retort, there was no cyber footprint, but by 2021 work had commenced on creating the new command, which opened in May 2023 and started functioning in October 2024. PAF has created a cyber range, where cyber warfare skills are built up by pitching blue and red teams against each other. Elements of the PAF Cyber Force played an active role in achieving the right effects during Op Bunyan-un-Marsoos, when cyber was integrated with kinetic ops. PAF kept it all relevant by participating in operations and exercises like Indus Shield 24.

Breaking the news

News on this clash broke in Europe later that day (May 7) when the ISPR held a press conference.

The PAF's Deputy Chief of Air Staff (DCAS Operations) and Director General Public Relations (DGPR) took much of the world by surprise, when they claimed the PAF had shot down five IAF fighters. These included three, later increased to four, extremely capable 4.5-generation Rafales fitted with the cutting-edge Thales Spectra electronic warfare systems. The air-to-air kills were backed up by images from social media accounts and included GPS co-ordinates of where they crashed.

As the PAF's DCAS Ops disclosed at the press conference, attended by both local and international media, the IAF were continuously scrambling their fighters in the early hours, to reinforce and saturate the air defence. "Our strategy was to have force concentration in our selected AORs and fight to our own strength.

"Once they saw our numbers, the IAF fighters launched their ground weapons, and we identified them. As soon as this happened, the Chief changed the rules of engagement from 'deter' to 'sure kill'.

"We targeted the Rafales, because the IAF had always said they would make 'the difference'."

The DCAS (Ops) talked with the aid of a screen at the conference about the losses and the locations where they were shot down. The PAF had tapped into IAF Rafale communications, and listened to a four-ship 'Godzilla 1-4' formation in panic and distress, having discovered one of the French jets was missing.

He ran the recordings to assembled media, which was quite startling at the time, but it seems the Rafale pilots were mistakenly talking on an open frequency rather than a secure one. During the stand-off, the PAF identified 14 Rafales within the 72 aircraft, through its electronic intelligence systems, and then targeted them.

The PAF also struck the radar in the northern ICCS (Integrated Command and Control Centre) at Barnala which effectively stopped all communications between the IAF leadership and their fighters.

The Indian military fired Brahmos air/surface-to-ground missiles capable of speeds of 3,000km/h (1,900mph) one after the other. I was told by the PAF there had been 'soft kills' and 'hard kills' by the Brahmos. There is some suggestion the PAF jammed the Brahmos frequencies but no one would confirm this.

During the press briefing, the PAF spokesperson showed the radar signatures of the Brahmos on the screen, which he said missed targets and flew into Afghanistan.

After 52 minutes, the IAF fighters fled back to their bases, outwitted by the PAF. A senior officer, told the author: "The Rafale is potent

PL-15 amazes the world

The export version of the PL-15E was exhibited at Zhuhai in 2021 and again in 2024. The author was told the PAF's version had a range of around 190km (120 miles). The longest distance that any of the PAF missiles hit their target, was around 190km (120 miles). According to the International Institute of Strategic Studies (IISS) the PL-15 is known for its long-range capabilities and energetic boost-sustain motor. The 'boost-sustain' element is believed to refer to a two-stage motor, providing both initial acceleration and sustained flight. It makes it capable of speeds greater than Mach 5. After being fired and entering its terminal phase, the motor's second pulse will ignite, providing the additional thrust to increase kill probability at long distances. If the missile is launched at supersonic speed, as it would have been by the J-10Cs, it can maintain speeds of Mach 5+ for much of the flight. It will inevitably begin to slow down post motor burn out.

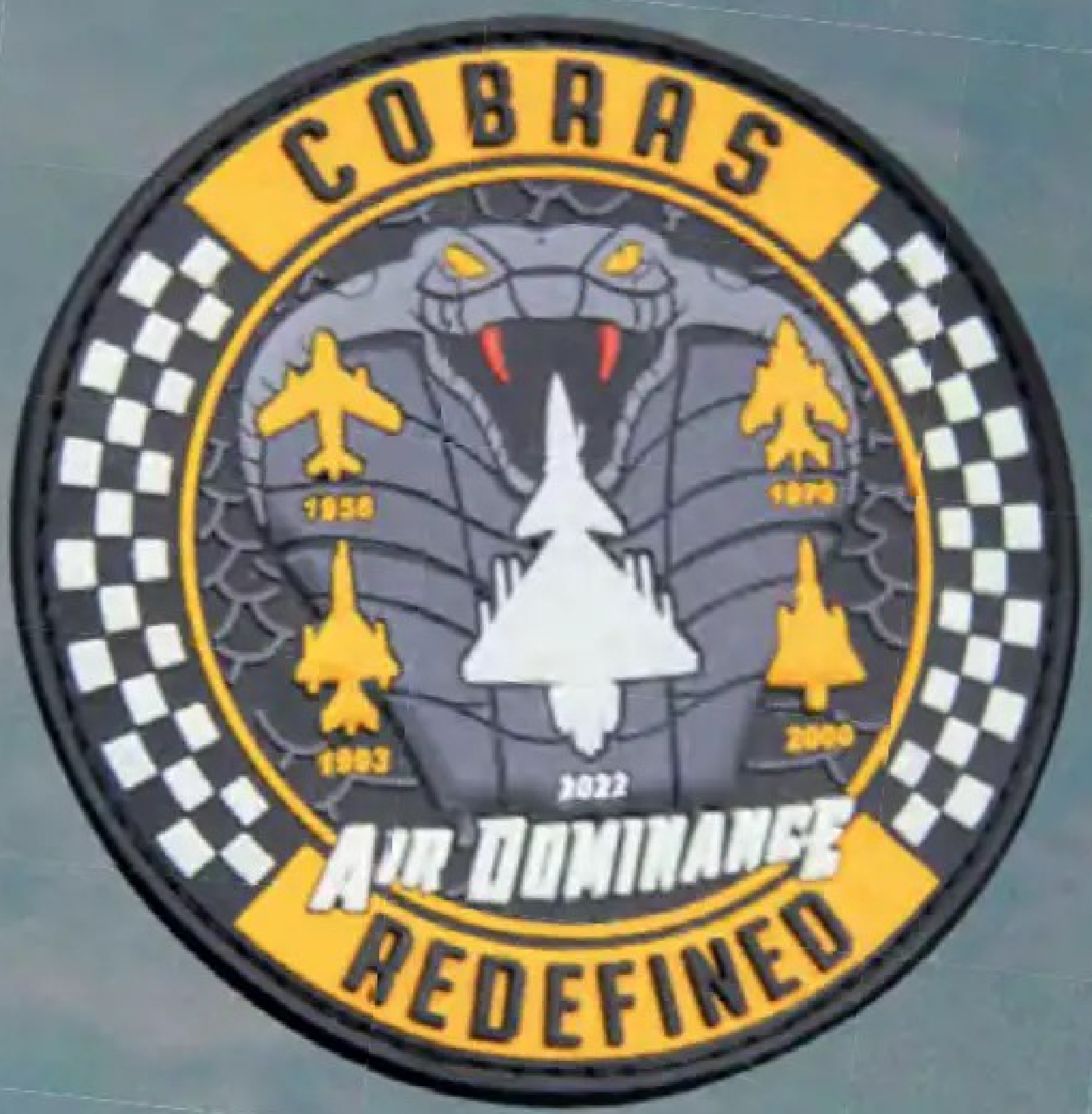
The PL-15/-15E is among a small number of AAMs that is guided by a miniature active electronically scanned array radar seeker that houses both active and passive modes. According to the IISS, Japan fields a BVR fitted with an AESA (AAM-4B) and there are suspicions that the US fields a AMRAAM version with an AESA that it doesn't export. According to the IISS, the missile features improved resistance to countermeasures and better performance against stealthy targets. It is also thought the hybrid guidance system supports a mini-course two-way datalink led by AEW&C aircraft.

The AEW&C can reportedly guide the missiles to their targets via Chinese XS-3 tactical data links, allowing them to be launched from a stand-off distance and "guided" to their respective targets... to remain undetected.

As a result, the PL-15E can be employed without relying on the onboard AESA radar for most of its flight, significantly reducing the likelihood of detection. The advantage of third-party targeting is in part that the launch aircraft may remain passive in the engagement.

Wg Cdr Bilal, Flight Cdr, Ops 15 Squadron, banks his jet to show off the four PL-15 missiles on the twin racks and single PL-10 on the outside hard points. The potent PL-15 struck a Rafale nearly 200km away. *Alan Warnes*

Armed and very dangerous


COBRAS
1956
1970
1993
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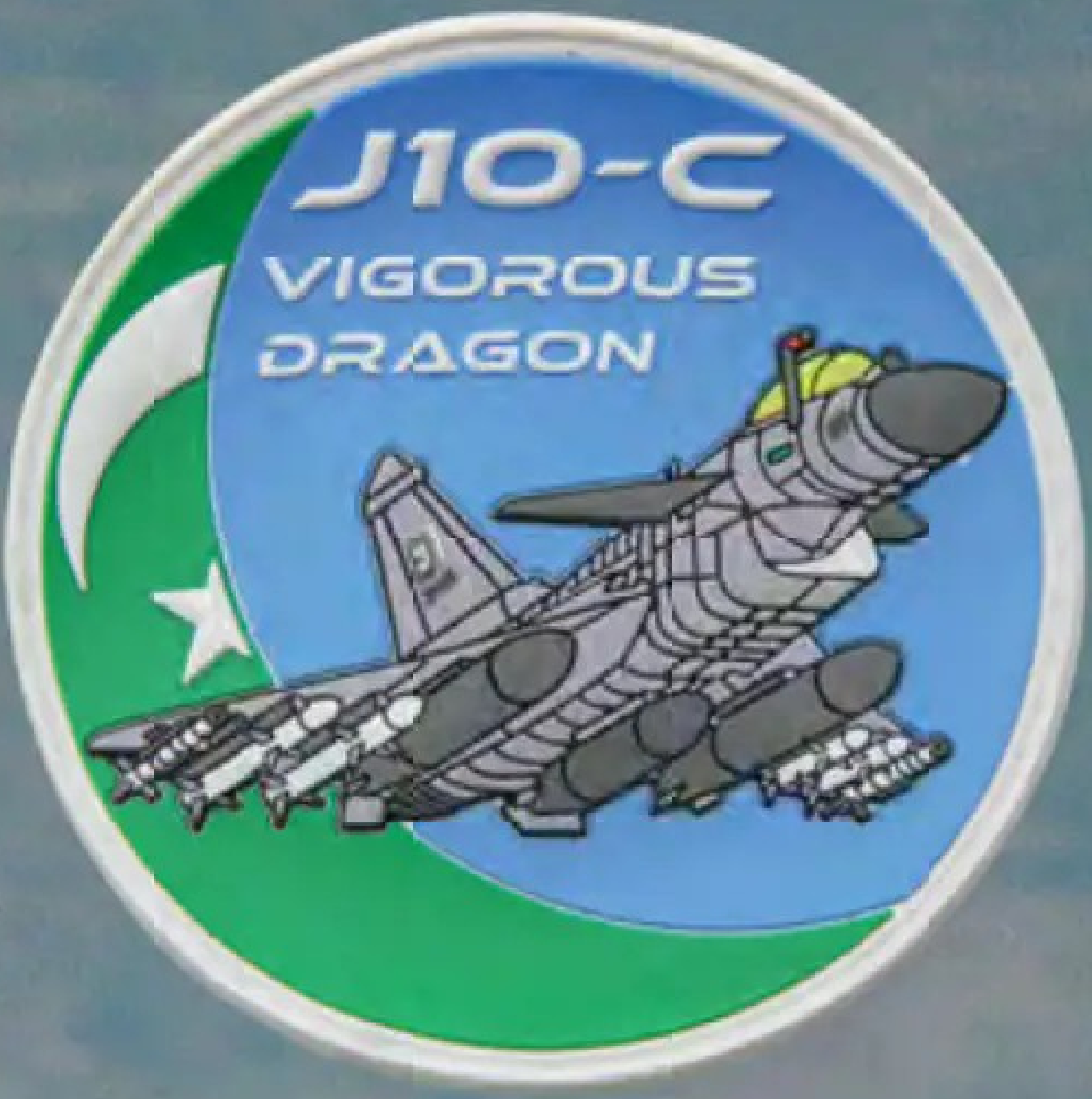
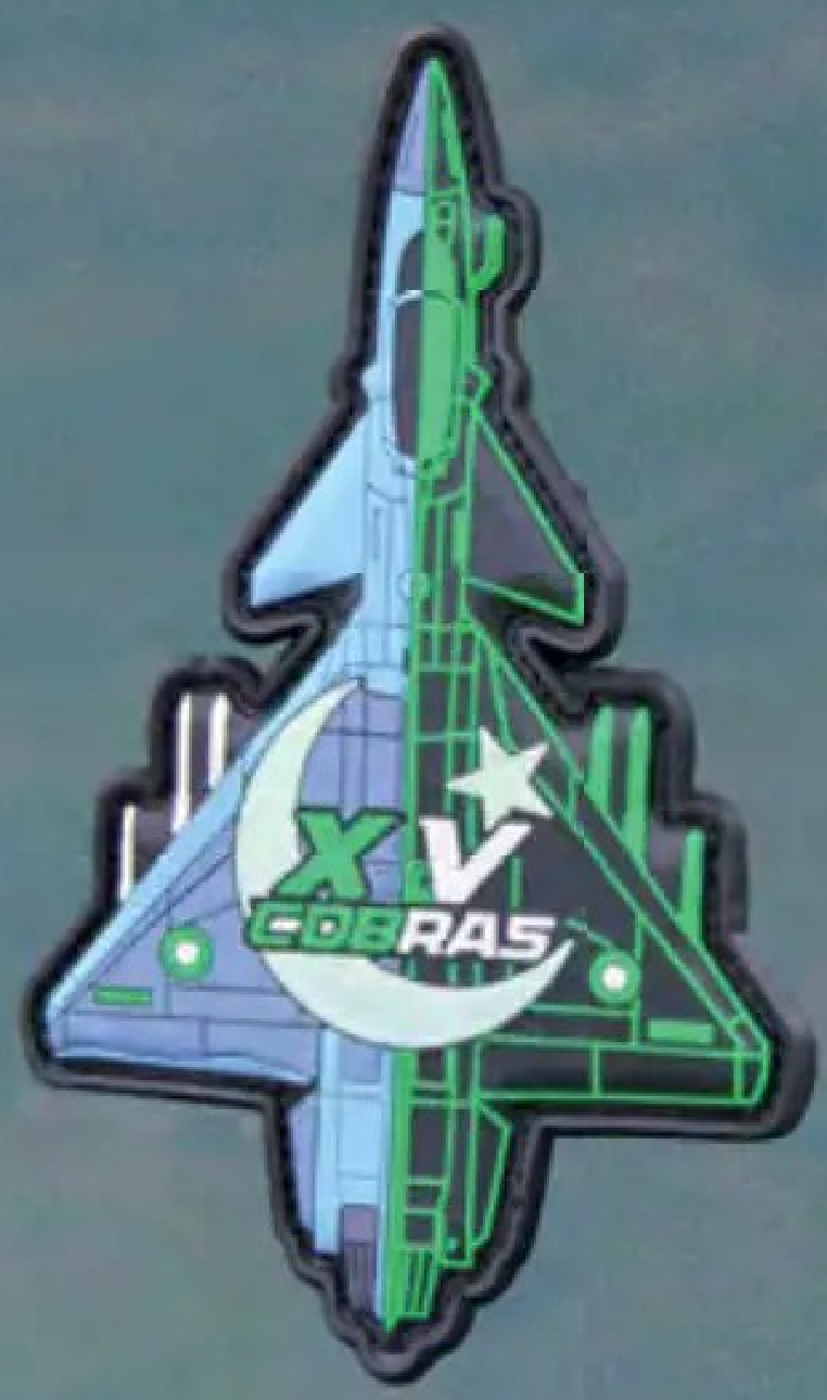
AIR DOMINANCE
REDEFINED

'Cobras redefined' – the 15 Squadron patch worn by the J-10C pilots


J10-C
VIGOROUS
DRAGON

A highly acclaimed J-10C Vigorous Dragon patch



Another PAF J-10C patch signifying two roles

DANGER
INTAKE
DANGER
119

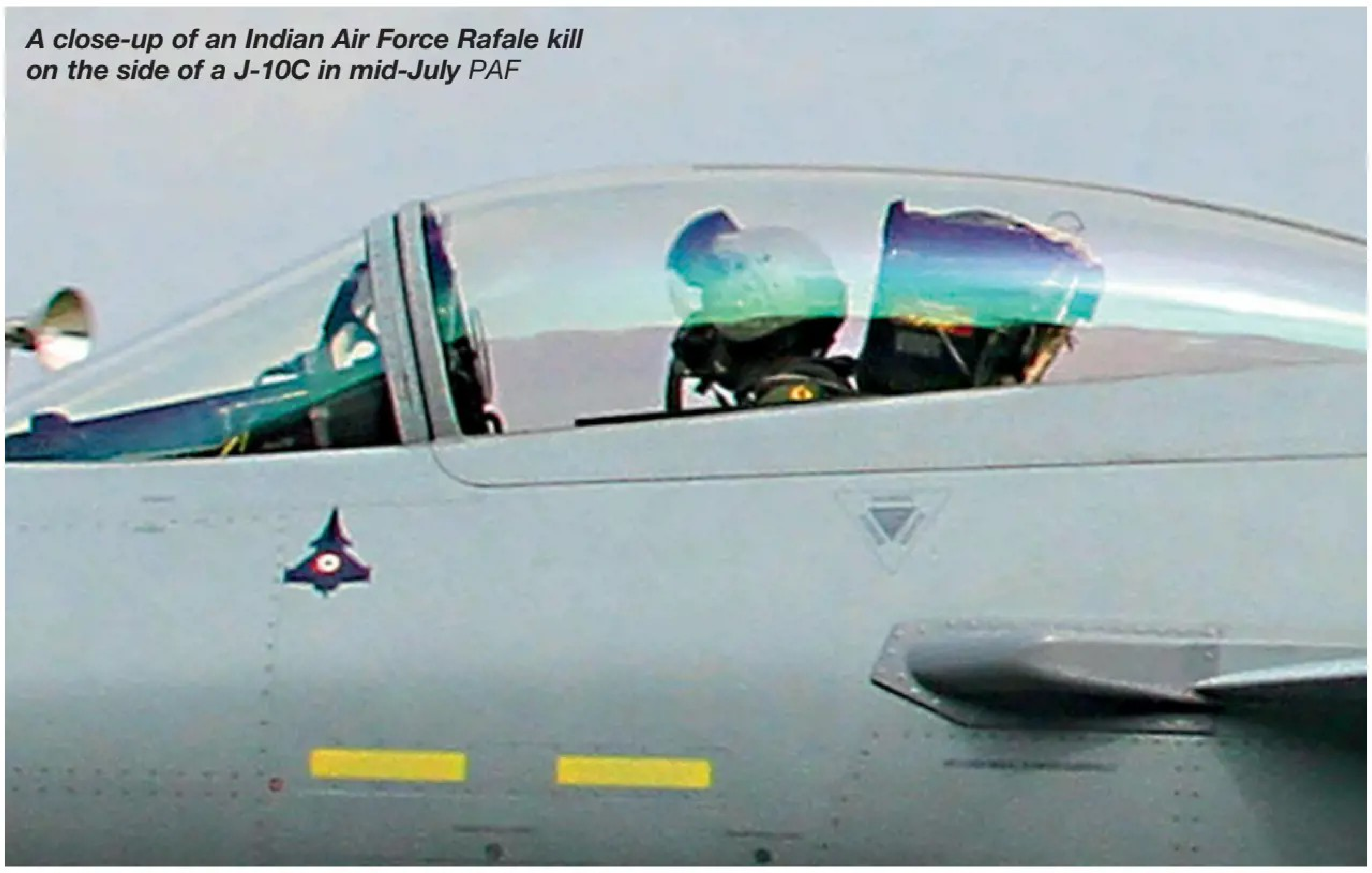
The JF-17C Block 3s were armed with the PL-10 and PL-15s, which was not publicly acknowledged until just before India attacked Pakistan. They never shot down an Indian Air Force jet during Pakistan's Operation Bunyan-un-Marsoos, probably because the jet's KLJ-7A radar does not match the range of the J-10C's KLJ-10 PAF

enough, and while we initially declared we had shot down three, BS001 [17 Sqn], BS022, BS027 [both 101 Sqn], we also had it confirmed by HUMINT [human intelligence] in mid-July that BS021 [from 101 Sqn] had been confirmed as shot down, over Srinagar."

The author understands another four aircraft have not returned to the flightline. The PAF has their tail numbers, because they know from their electronic intelligence the jets that were badly damaged. They are endeavouring to confirm from OSINT (Open-Source Intelligence/HUMINT – often spies on the ground). The PAF refrained from attacking further than 2,000km (1,250 miles) away because it felt it could start an all-out war.

Rafale kills

The author, understandably, wanted to know how the PAF could identify the downed aircraft, as many of the Indian public will not believe it. As a retired officer explained: "In



A close-up of an Indian Air Force Rafale kill on the side of a J-10C in mid-July PAF

No 29 Squadron is the PAF's Aggressor squadron, that commenced flying operations on January 23, 2019, just before Op Swift Retort took place on February 27, 2019. It is an integral part of the ACE facility, playing Red Air during exercises like Saffron Bandit and Indus Viper. The J-10C pilots have also trained as Aggressors and will undoubtedly be a big attraction for foreign air forces attending Indus Viper next year

this BVR war, it's very difficult to show the wreckage of the jet you have shot down, because they fell in Indian territory. Although there were many images appearing on social media, our foe will never admit it, so what we do is judge the 'kill' with different parameters as most air forces do.

"Our Identification (ID) Matrix is a structured process that ensures accuracy, accountability, and verification in air combat operations. It begins with the detection of an aircraft radar, followed by its positive identification within the Comprehensive Complete Air Picture (CCAP) at the command centre, where every Indian aircraft is clearly tagged and tracked.

"Once detection is confirmed, the next step involves assessing the lock parameters of the missile system, which can only engage a target within specific speed, range and angular limits. After securing a lock on the target, the missile is launched, and its progress is monitored through radar tracking. If the target's radar signature disappears from the CCAP screen, it is registered as a 'probable kill'.

"However, the process does not end there, upon returning to base, the pilot undergoes a thorough debrief in which the mission video recording is reviewed to validate that the missile engagement met all required parameters – direction, speed, lock range and envelope. This Multilayered ID Matrix not only guarantees the precision of engagements but also ensures transparency and post-mission verification, making it a cornerstone of the PAF's credibility in confirming air-to-air victories. Once these steps had been processed, the PAF tried to confirm the 'kills' by OSINT/HUMINT."

None of the above could be done without the seamless integration of radar inputs from multiple field radars and sector headquarters to create the CCAP at Command HQ. This process by the PAF ensures that data from geographically dispersed radars is fused into one unified, real-time operational display. Instead of each radar working in isolation, their coverage areas are digitally overlapped and synchronised, eliminating gaps and blind spots. The PAF achieves 360° surveillance of national airspace, enabling commanders to track, identify, and prioritise aerial threats with precision. It enhances situational awareness by filtering and corelating radar feeds, thereby reducing the duplication or misinterpretation of targets. As the senior officer told the author: "[Radar] Knitting symbolises the transition from localised radar control to network-centric defence system, empowering the PAF to maintain air superiority through unified awareness, co-ordinated response, and robust command and control."

The PAF provided the Rafale tail numbers, BS001, BS021, BS022 and BS027 to allow Dassault an opportunity to clarify if the aircraft was still current. Much of the Indian population and news channels still refuse to believe the Rafales were shot down, but while the IAF refutes these allegations, they have yet to provide post-May 7 images of the four jets with the serial numbers and close ups of their manufacturers' serial number.

Dassault has remained tight-lipped, although it did quite unusually put out a press release denying that its CEO Eric Trappier had said "no Rafales were shot down" after this was circulating on social media.

Sources told the author: "We have video recordings of the downed aircraft and battle damage assessment imagery which we intend to release at the time of our own choosing and when we deem it appropriate which will cause further embarrassment to the IAF."

Indian acknowledgement

The Indian Chief of Defence Staff, General Anil Chauhan, admitted to Bloomberg Television on May 31, that IAF jets had been shot down that night. He denied Pakistan's tally of six but declined to specify the exact number. "What is important is not the jet being [shot] down, but why they were downed," Chauhan said. "Numbers are not important."

He admitted tactical mistakes were made during the conflict, although he observed that the Indian military did carry out long-range precision strikes on targeted installations.

Chauhan finished: "The good part is that we are able to understand the tactical mistakes, remedy them, and implement them again."

His admission was overshadowed by a bolder statement from a political heavyweight in India, Subramanian Swamy, who acknowledged the loss of at least five Indian aircraft during the clash.

On August 9, Indian Air Force commander Marshal Amar Preet Singh, who has been in office since September 2024, prompted

Op Swift Retort

During Operation Swift Retort, an IAF MiG-21UPG Bison (serial no CU-2328) was shot down by a PAF F-16A piloted by Wg Cdr Nouman Ali Khan over Balakot on February 27, 2019.

The IAF Chief of the Air Staff at the time, ACM Birender Singh Dhanoa, claimed the MiG-21 pilot, Wing Commander Abhinandan Varthaman who was captured by Pakistan, had shot down a PAF F-16C with one of its R-77 *Adder* or R-73 *Archer* missiles, before it crashed.

This was simply untrue, as I had the opportunity to visit the MiG-21 wreckage sometime later, and the four missiles were all damaged but still intact. The US government also denied a F-16 had been lost.

The PAF also claimed a Su-30MKI *Flanker* was shot down that night, and while they did not have any verifiable wreckage, the AIM-120C missile that was fired by F-16B pilot, Wg Cdr Hassan Siddiqui, according to the PAF met all the parameters of a kill. The jet was later seen at an Anatolian Eagle exercise at Konya, Turkey sporting an Indian kill.

An IAF SPYDER (Surface-to-air Python and Derby) surface-to-air missile battery shot down a IAF Mi-17 helicopter in a friendly fire incident the same day, an incident that the IAF initially put down to 'a crash during to routine ops'. Seven months later, the IAF backtracked and confirmed it was indeed shot down by a SPYDER based at Srinagar Air Force Station ten minutes after it left the base. In 2023 the Chief Operations Officer (COO) of Srinagar AFS at that time, was dismissed from the IAF.

The Saab 2000 Erieye was the unsung hero of Op Bunyan-un-Marsoos, supporting the situational requirements of the fighter packages

ripples of disbelief while addressing an Air Force Association gathering in Bangalore by saying: "We shot down five PAF fighters and an AEW&C Erieye with our S-400 SAMs at a range of 300 kilometres."

Coming three months after the battle had concluded, it not only contradicted the earlier admission by his superior, General Chauhan, but also lacked any supporting evidence.

It appeared to be a desperate attempt to placate Prime Minister Modi, whose government has been under mounting pressure to mask the scale of the IAF's losses. The stark contradiction between India's top military leaders underscores the turbulence within its defence establishment.

Training to fight Rafale

The IAF had bought 36 Dassault Rafales in 2016, along with MBDA Meteor BVRAAMs, MBDA Scalp EG/Storm Shadow cruise missiles and Safran AASM Hammer glide bombs. The author sensed during subsequent visits to the PAF, that it was a concern for the leadership. Undeterred, they set about training to fight the Rafale and the European BVRAAM. In 2020, the PAF ordered both the long-range PL-15 and short-range PL-10 missiles which could be a game changer against the Meteor.

The PAF's new tactics development school went into overdrive, employing the PAC/Chengdu JF-17 and Lockheed Martin F-16s against Rafales in simulations. Every possible avenue was exploited to understand the weaknesses of the French jet.

Asked if the air forces of Qatar or Egypt had helped with this? ACM Sidhu said: "No. Because neither side fly the Rafale in the same tactical manner as India does."

In the 1990s, before the PAF took delivery of the AIM-120 AMRAAM, it concentrated on within visual range (WVR) tactics, and according to the RAF and USAF pilots the author had talked to after exercises with them, they were very good at it. But it was different now.

Multi domain warfare

When ACM Sidhu became PAF Chief of the Air Staff on March 19, 2021, he ushered in some very big changes, realising the importance of different challenges of Air Power, and wanted to confront them through indigenous efforts.

On the operational side, he invested time and resources into new domains like cyber, electronic warfare and space, as well as ground-based air defences and unmanned aerial vehicles. He would then integrate them with the operational fighters in what he refers to as 'multi domain warfare'.

In June 2021, just three months after taking office, ACM Sidhu ordered 20, now much-prized Chengdu J-10Cs from China. They would be armed with the very long-range PL-15 and shorter-range PL-10 air-to-air missiles. The first

No 221
INDIAN
AGGRESSORS
VANGUARDS OF OPS SWIFT RETORT
No 51
INDIAN
CU2328

This Operation Swift Retort memorial at Mushaf, heralds the work of the based aggressors which claimed the shoot down of a Su-30MKI* Flanker *and highly publicised MiG-21 Bison

Sitara-i-Jur’at gallantry awards

Eight PAF pilots won Pakistan’s third highest military award, the Sitara-i-Jur’at (Star of Courage), for their role in Op Bunyan-um-Marsoos

Rank/name	Role
Wg Cr Bilal Raza	Flt Cdr (Ops) 15 Sqn, Minhas
Wg Cdr Hammad Ibne Masood	2 i/c/Flt Cdr (Ops) 14 Sqn, Rafiqui
Sqn Ldr M Yousaf Khan	Sqn pilot, 14 Sqn Rafiqui
Sqn Ldr Muhammad O Ishfaq	Sqn pilot, 15 Sqn, Minhas
Sqn Ldr Muhammad H Anees	Sqn pilot, 15 Sqn, Minhas
Sqn Ldr Talal Hassan	Sqn pilot, 15 Sqn, Minhas
Sqn Ldr Fida Muhammad Khan	Sqn pilot, 15 Sqn, Minhas
Sqn Ldr Muhammad A Amir	Sqn pilot, 15 Sqn, Minhas

six J-10Cs arrived on March 4, 2022. A multi-domain operations centre (MDOC) and a National ISR Air Ops Centre (NIIAOC) were two of many new departments the Commander created, where along with his staff and personnel, he could watch all these new assets interlinked while controlling the PAF’s every move.

At the same time, the Airpower Combat Employment (ACE) facility at PAF Base Mushaf, created in 2016, was upgraded considerably into one of the best tactical training ranges in the world. In 2023 it was relabelled the Aerospace Power Centre of Excellence (ACE).

ACE is where PAF pilots and GCIs can test their capabilities and skills against each other and with international allies during Indus Shield exercises. Two have taken place to date, in 2023 and 2024. During the latter, 24 nations, including observers, participated with Royal Saudi Air Force Tornados, Turkish Air Force F-16C/Ds and Egypt F-16Cs present.

A senior officer told me: “We embraced fifth-dimensional warfare, with a highly effective cyber force that we built with support from the National Aerospace Science Technology Park [NASTP]. The aim is to support PAF ops, both kinetic and non-kinetic effects. We practice everything at ACE.”

NASTP is an interesting development, a bold leap into the future that wasn’t even an idea when the author last visited in 2020, where academia, industry and the government are linked together through an impressive ecosystem. It isn’t just a technology park for innovation; it has been created to pursue the Air Chief’s vision of a launchpad for strategic autonomy.

The level of intelligence being gleaned from India through different domains, as the author observed at the NIIAOC, is quite unbelievable. The author was allowed exclusive access to the facility, where even the most senior officers are often not allowed to visit.

Every Indian base could be monitored, every aircraft from the moment of lift-off in Western Command was tracked. There are Pakistani eyes everywhere. During my time with the PAF it was obvious there was nothing the PAF didn’t know about the IAF.

From the start of the contingency op and as the tension with India escalated, the PAF Commander made the command centre his home, snatching sleep whenever possible on a mattress in a side room. He said he felt it was a once-in-a-lifetime opportunity and he didn’t want to miss anything.

Alongside him in the command centre were the heads of all the new integrated domains, EW, Cyber and Space; there were air defence controllers, along with the head of the main kinetic force – the fighters in the air. He consulted with them, before making decisions in what the PAF calls ‘centralised control and decentralised execution’.

Several officers who worked with the CAS, told the author how the ‘boss’, as they refer to him, took the lead on everything, even telling the J-10C pilots when and where to fire.

Indian strikes then a response

According to the IAF, retaliatory strikes took place at 11 different military air bases, on May 10. The bases included PAF Base Nur Khan near Rawalpindi, which was, according to the PAF, struck by Spice 2000 PGMs released by Mirage 2000s. It missed the HQ-9 missile battery at the facility.

Rafiqui was also struck, as was a hangar at PAF Base Murid, the home to four squadrons of UAVs, and the runway at Rahim Yar airfield that the IAF says plays a strategic role in Pakistan’s air defences, but is a civil airport used by the UAE Royal family for hunting trips.

PAF Base Bholari was subjected to an attack on one of its hangars, that claimed the lives of five PAF personnel and damaged a Saab 2000 Erieye that the PAF says has been repaired. The runway at PAF Base Mushaf was struck but was made operational again within a few hours.

AGGRESSORS
VANGUARDS OF OPS SWIFT RETORT

A close-up of the 29 Squadron memorial, giving all the names of the pilots on the unit during Op Swift Retort. The OC, Wg Cdr Nouman Ali Khan, shot down the IAF MiG-21 Bison with an AIM-120 AMRAAM ‘Slammer’ while flying a 11 Squadron jet

MISSION TO KILL
AGGRESSORS
TACTICAL DOMINANCE GUARANTEED

The 29 Squadron Aggressors’ patch

A 16 Squadron JF-17C Thunder Block 3 taxies back to the unit's shelter area at Kamra-Minhas. The Black Panthers played a major part in the air defence of Pakistan on May 6/7 PAF

> ***"They were sitting ducks - they didn't stand a chance when our J-10Cs unleashed those PL-15s."***

In retaliation to the IAF offensive and loss of civilian lives, the PAF sent indigenous killer drones assembled by the NASTP into India flying over the bases at Adampur, Agra, Bhantral, Bhatwala, Bhuj, Gujrat, Srinagar and even the capital, Delhi, where they flew orbits overhead, packed with 20kg explosives. The drones with PAF's homegrown front and back-end technologies were not met with any resistance because the IAF's air defences had been blocked, and as a result the IAF was practically grounded.

Over the next few hours on May 10 the PAF hit 34 targets on different bases, half were by fighters, the rest were struck by the killer drones. While the PAF was initially aggressive, everything became measured, and more could have been taken out, according to a PAF senior officer, who told me they even had a lock on a A-50 AWACS lining up at Agra, but the attack was stopped, according to the PAF, so the IAF could save face.

For seven days, after the strikes ended, only one aircraft flew from Western Command and that was a Rafale that dropped a Scalp EG/ Storm Shadow cruise missile, working with an A-50 AWACS.

SEAD

One of the biggest threats to the PAF, alongside the Rafale, is the mobile S-400 air defence system. They needed them to be destroyed, because they are extremely dangerous. So much so, the PAF was monitoring their every move in Western Command – at Adampur, Bhuj and Bikaner.

The S-400 is a long-range Russian mobile surface-to-air missile (SAM) system - the SA-21 *Growler* - designed to destroy a wide range of aerial threats, including ballistic missiles, cruise missiles, aircraft and drones. It is considered one of the most advanced SAMs in the world, capable of engaging multiple targets simultaneously. Most NATO fighter forces train to counter the S-400 and will be very interested in how the PAF fared. The system has a range of up to 400km (250 miles), engage targets up to 100,000ft (30km) and track up to 300 targets, engaging 36 of them simultaneously. It is deadly.

The PAF was not keen to share the S-400's MAR (the distance from which the SAM can hit its target). Needless to say, the JF-17s needed to get close to the range of the S-400 to fire its two long-range supersonic Chinese-made CM-400AKG missiles.

In the early morning of May 10, a JF-17C Thunder Block 3 of 14 Sqn 'Tail Choppers' departed Rafiqui on a deadly Destruction of Enemy Air Defence (DEAD) mission, to destroy the S-400 system deployed to Adampur. As the JF-17 headed towards the target, the S-400's radars were being saturated by a substantial amount of jamming and other electronic warfare methods. At the same time, the JF-17 was spitting out decoys coupled with evasive manoeuvres.

As it got inside the S-400's firing range, the pilot was ordered to fire his CM400AKGs. He flew well inside the Rafale's Meteor's MAR but thankfully for the pilot, there was no resistance.

According to the PAF, the CM-400AKGs scored a direct hit on the 'Cheese Board' low altitude tracker and 'Big Bird' early warning and broad surveillance radars, and as a result put the S-400 missile launchers out of action. Three days later, the Indian PM, Narendra Modi, visited Adampur AFS, where he posed for a photo in front of a S-400 missile system to show that it was still operational. But as the PAF Commander said: "They didn't show him with the radar systems – without them it is useless."

The CM-400AKG is China's long-range air-launched air-to-ground weapon, powered by a solid-fuel rocket that can reach supersonic speeds of Mach 5. It is passive, so doesn't need to be guided onto the target by radar. The range of the S-400 missiles (up to 400km) is the same as the JF-17's CM-400AKG.

As the senior officer told me: "To get inside the range of an S-400 radar and come back alive is quite an achievement because you are giving the missile a chance to shoot you down. You must employ your game plan and the maximum range you can go. We employ scenarios through ACE and Combat Commanders School (CCS), flying them regularly again and again as we do on the squadrons." So, what happened was no different than what the PAF had trained for. Similarly, the PAF gave a crippling blow to the IAF by destroying the IACCS at Barnala.

Cobras

No 15 'Cobras' Squadron and its J-10Cs played a massive part in defeating India's ambitions on May 7. It is testimony to the way they train, that the pilots who went into battle only had between 100 and 120 hours on the Chinese jet. During the three years in service, they had spent much of their time devoted to air-to-air combat training in the likes of 2v2, 4v4, 8x8, 10v8 scenarios.

The current office commanding (OC), who for security reasons did not want to be identified, said: "In a relatively short span of three to four years, the PAF has inducted a new generation aircraft. While the Chinese have operated the J-10 for two decades, they haven't employed it the way we have and that's because of the PAF's training. The best pilots were recruited from the F-16 Viper and JF-17 Thunder forces and transferred to the J-10.

The IAF received their Rafales years before the PAF received its J-10s (the first five were delivered in July 2020) and they had more (36) too.

Incredibly, the six pilots who went to Chengdu in China to train on the J-10C, flew just two to three hours before ferrying six jets back to Kamra-Minhas in March 2022.

The PAF needed them quickly because of the rising Rafale threat, and within nine months they were operational. Much of that time was spent mastering the tactical sensors, working in all the different spectrums, including air-to-air refuelling. It took the PAF just eight months to get the jets to Pakistan after the contract was signed. Compare that to the Rafale in India, and the five to six years it took from contract signature to being operational.

The J-10C's KLJ-10 Active Electronically Scanned Array (AESA) radar improves detection and targeting in environments that pose a longer range over the F-16C Block 52's older mechanically scanned AN/APG-68 radar system, allowing the J-10C to engage targets from a much greater distance. PAF J-10Cs reached fully operational capability by early 2023 and were involved in a national level exercise the same year. The threats that PAF can simulate in J-10Cs are unlike anywhere else in the world.

The PAF's 'Radar Knitting' and 'ID Matrix' processes were extremely good during the air battle, while the rules of engagement were very clear, something that the IAF lacked in the conflict.

The 15 Sqn OC continued: "The CAS has brought ACE on a lot since 2016, back then it was more Air Power, than Aerospace and was more rudimentary for the pilots and fighter controllers. Now it includes air battle management and GBADs [ground-based air defences] and there is an operational interface with the Joint Strike Simulation Centre at ACE."

The author visited the ACE's Joint Services command and Staff College (JSSC) where students develop game plans, with air defence assets like GBADs alongside radars, electro-optical sensors and passive sensors enabling recognised air pictures. They then run it, to see how it works before they flew the mission. In the first international Indus Shield exercise at ACE in 2023, 14 countries attended and on the second in 2024 there were 24. A former Turkish Air Force F-35 pilot, now an F-16 Sqn Commander, told the OC 15 Sqn: "Indus Shield is similar to the USAF's Red Flag and in some domains better. vThe PAF is now working in a multi domain warfare and while very aggressive, they are disciplined."

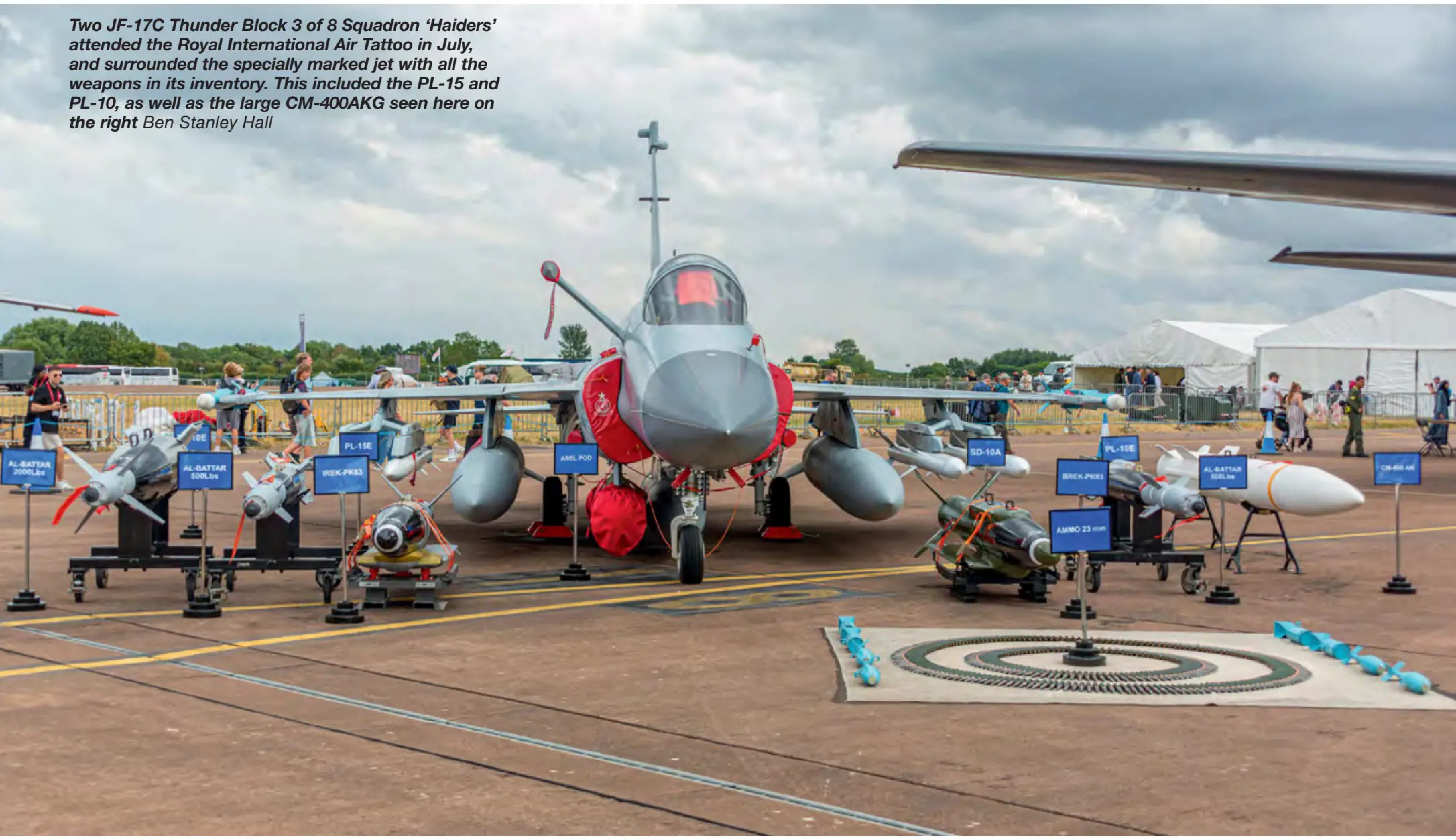
Pakistan and India have already fought each other in two wars, since Pakistan gained independence in 1947. There have also been two major skirmishes between the PAF and IAF – Kargil in 1999 and Swift Retort in 2019, but this latest confrontation, that saw the biggest BVR air war ever witnessed anywhere in the world, is a sign that nothing will change anytime soon. With tension running high between the two nations, things could even get worse... **afm**

About the author

I have visited the Pakistan Air Force over 20 times, since first going to Pakistan in May 2001. I had not visited since 2020, due to family reasons and because the PAF was going through huge modernisation. This year, facilitated by the support of veterans and senior officers, I re-established my association with the PAF and had the privilege of visiting various facilities in July.

From being primarily fighter-centric when I last visited, the PAF has now emerged as a full-spectrum, multi-domain force operating seamlessly across space, cyber, artificial intelligence, drone warfare and integrated kinetic air power. As a result, the PAF I have observed now stands as a contemporary, forward-looking air force that is ready to meet the challenges of modern warfare head-on.

The author, Alan Warnes



Two JF-17C Thunder Block 3 of 8 Squadron 'Haiders' attended the Royal International Air Tattoo in July, and surrounded the specially marked jet with all the weapons in its inventory. This included the PL-15 and PL-10, as well as the large CM-400AKG seen here on the right *Ben Stanley Hall*

"We targeted the Rafales, because the IAF had always said they would make 'the difference'."

A JF-17C Block 3 Thunder of 16 Squadron spits out flares

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843/25

GERMANY'S WILD WEASELS

Babak Taghvaee looks at the role of Germany's Tornado ECRs and the future of Wild Weasel warfare in the Luftwaffe

Germany's Panavia Tornado ECR (Electronic Combat Reconnaissance) fleet continues to serve as a linchpin of NATO's electronic warfare and Suppression of Enemy Air Defenses (SEAD) capability in Europe. Developed in the late 1980s as a specialised offshoot of the multirole Tornado IDS, the ECR variant was purpose-built to locate, track, and neutralise hostile radar and surface-to-air missile (SAM) systems using a combination of anti-radiation missiles and sophisticated electronic countermeasures. While many of its Cold War contemporaries have been retired, the Tornado ECR remains operationally relevant due to successive modernisation programs and its proven effectiveness in NATO operations.

As of mid-2025, the Luftwaffe maintains a fleet of 22 Tornado ECRs out of a total of 93 Tornados in service. The bulk of the ECR fleet (21 aircraft) is concentrated at Taktisches Luftwaffengeschwader 51 (Tactical Air Force Wing 51, TLG51), based at Jagel-Schleswig, with an additional ECR assigned to the weapons and systems testing unit, Wehrtechnische Dienststelle 61 (Military Technical Center 61, WTD61). Under the stewardship of highly experienced personnel – many with thousands of hours on the type – TLG51 continues to sustain the fleet's high operational readiness, despite mounting logistical challenges and shrinking spare parts availability. According to the wing's deputy commander, Lt Col Bjoern Jansen, this sustained readiness is a testament to the technical group's dedication, often working late into the night to keep the aircraft mission ready.

Far from being a relic, the Tornado ECR has undergone multiple Avionics Software System Tornado in Ada (ASSTA) upgrades. The ASSTA 3.1 baseline introduced colour multifunction displays and Link 16 integration, significantly improving crew situational awareness and data sharing across NATO assets. The ongoing upgrade to ASSTA 4.1 and the anticipated ASSTA 4.2 software standard further extend the ECR's capabilities, including integration of the AGM-88E Advanced Anti-Radiation Guided Missile (AARGM), which Luftwaffe aircraft successfully tested in April 2025 at the US Navy's China Lake test range.

Although Germany will start phasing out its Tornado IDS fleet in favour of the fifth-generation F-35A Lightning II – ordered primarily to fulfil NATO nuclear-sharing commitments – the Ministry of Defence has no plans to use the F-35 in the SEAD/DEAD (Destruction of Enemy Air Defenses) role. Instead, the ECR variant

Tornado ECR 46+32 of TLG51 and an EA-18G Growler from VAQ-140 (168252/AG-505) of the US Navy refuel from a NATO A330-243MRTT (T-055) during Exercise Neptune Strike-22.2 on October 20, 2022 *US Navy photo*

Two Tornado ECRs configured in different roles. The closest is optimised for a DEAD mission armed with two AGM-88 HARM captive training missiles. The furthest is in tactical recce mode fitted with a RecceLite pod, as they were used in Operation Inherent Resolve *Dr Stefan Petersen*

will continue to serve as Germany's dedicated electronic attack and Wild Weasel platform until the start of their gradual retirement and replacement with Eurofighter EK (Electronic Combat) in 2030. Its continued relevance, both as a national asset and NATO contributor, rests on a strategic decision: to invest in what works while transitioning cautiously to what's next.

The German Tornado Fleet: Composition and Deployment

The Luftwaffe operates its 93 Tornado aircraft in three distinct variants: the Interdiction/Strike (IDS), the dual-control IDS(T) trainer, and the Electronic Combat Reconnaissance (ECR) variant specialised for SEAD/DEAD missions. These aircraft are distributed among three active units, each tasked with a unique operational mandate within NATO's integrated air power structure.

The smallest portion of the fleet is assigned to WTD61 at Manching, which maintains five Tornados: two IDS, two IDS(T), and one ECR. These aircraft support weapons integration, avionics testing, and flight certification activities vital to the long-term viability of the platform, especially as modernisation efforts continue through the ASSTA program.

The bulk of Germany's SEAD-capable aircraft are assigned to TLG51 at Schleswig-Jagel. The wing operates 43 Tornados: 12 IDS, ten IDS(T), and 21 ECR. Forty of these aircraft are part of the operational cycle, with approximately 28 to 33 typically airworthy. TLG51 remains a cornerstone of Germany's electronic warfare capabilities, regularly participating in NATO exercises and maintaining high levels of tactical readiness.

TLG33, temporarily operating from Nörvenich while its home base at Büchel undergoes modernisation to receive the F-35A, operates 45 Tornados: 40 IDS and five IDS(T). Of these, ten IDS and four IDS(T) are in active rotation. The wing holds Germany's nuclear strike responsibility under NATO's nuclear-sharing arrangement, with select Tornado IDS aircraft configured to deliver B61-series tactical nuclear bombs.

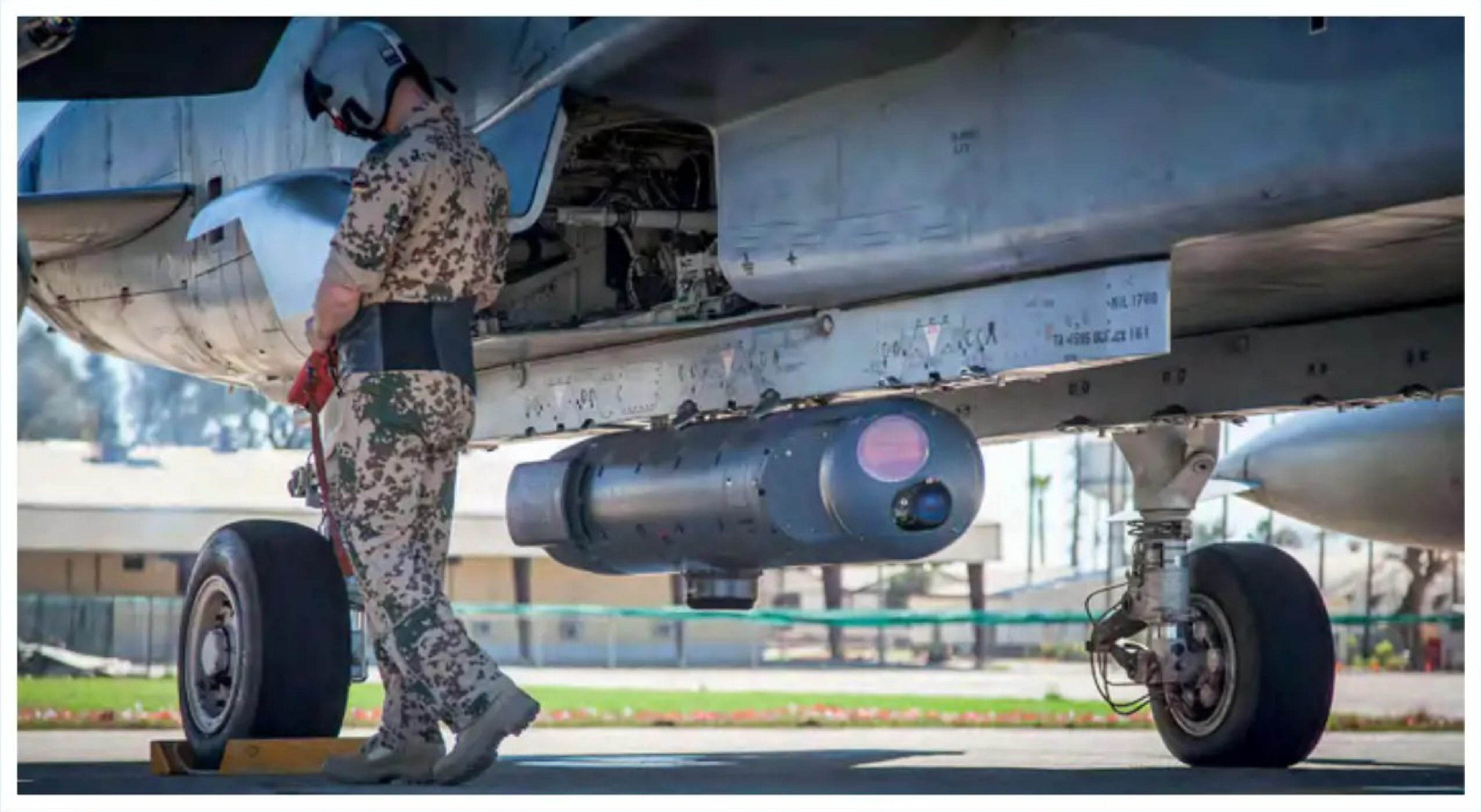
Despite growing logistical challenges associated with ageing airframes, the Luftwaffe maintains 60-70% fleet availability across the force, with roughly half of all Tornados fully mission capable at any time. Each unit plays a critical role: WTD61 sustains the technical underpinnings of the platform, TLG51 delivers SEAD and electronic attack capabilities, and TLG33 secures Germany's role in NATO's nuclear deterrence posture.

Still Germany's Spearhead in SEAD/DEAD

While the Luftwaffe prepares for a generational shift in its strike capabilities, the Tornado ECR remains Germany's primary asset for SEAD/DEAD. Tailored for electronic attack operations, the Tornado ECR is specifically designed to detect, engage, and neutralise adversary radar and missile threats. Its continued operational relevance – more than three decades after its introduction – is a testament to both its robust design and the Luftwaffe's commitment to iterative upgrades.

At the core of the Tornado ECR's capability is the Texas Instruments Emitter Location System (ELS), which enables the aircraft to passively detect and geo-locate enemy radar emissions. Lt 'Daniel', a weapon systems officer at TLG51, explained: "Our role is to find, fix, and attack enemy air defences, suppressing them to protect our attack aircraft as they approach their targets. After major updates, our Tornados are pretty much state-of-the-art for locating enemy air defence systems."

Armed with AGM-88 series anti-radiation missiles including both the legacy HARM and the more advanced AGM-88E AARGM, the Tornado ECR delivers kinetic suppression against active radar threats. It also employs the 500lb GBU-54 Laser Joint Direct Attack Munition (LJDAM), offering the flexibility to destroy air defence nodes even when emissions are not present. These precision-guided munitions enable the ECR to strike both emitting and non-emitting targets with high accuracy.



A Rafael RecceLite ISR pod installed under a Luftwaffe Tornado ECR at Al-Azraq AB during Operation Inherent Resolve in 2019
Bundeswehr/Falk Bärwald

Like the IDS, the Tornado ECR can be fitted with a buddy refuelling pod on the centreline station. When used as a tanker, it can deliver up to 5,500kg (12,000lb) of fuel under optimal conditions
Bundeswehr/Ralf Nöhmer

Pilots and weapon systems officers of TLG51 walk towards their Tornado ECRs during a readiness exercise *Bundeswehr*

Yet destruction is not always the goal. Luftwaffe doctrine emphasises suppression through presence. As Lt 'Daniel' noted: "We would not necessarily have to launch our HARMs during wartime missions to be successful. We are also successful if we force the enemy to shut down their radars and air defences through our presence, effectively suppressing them for a few hours while our attack aircraft pass through their threat ring."

This approach requires tight co-ordination with strike formations. Tornado ECR crews must align their ingress timing, altitude, and threat engagement windows with the planned time-on-target of friendly bombers. Most missions are flown at medium altitudes (8,000–24,000ft) due to peacetime restrictions in European airspace, but ECR pilots routinely train at low level, where the aircraft performs best and is safest against radar-guided threats. "In an actual conflict, we would prefer to fly very low," Lt Daniel added.

In April 2025, the Luftwaffe demonstrated its continued commitment to evolving SEAD/DEAD capabilities with a live firing campaign at the US Navy's China Lake test range. Tornado ECRs from TLG51 successfully launched AGM-88E AARGMs in a controlled operational environment, validating integration of the new missile under the ASSTA 4.1 modernisation package. The AARGM, which features GPS/INS navigation, a passive radiation seeker, and an active millimetre-wave radar terminal phase, significantly enhances the Tornado's ability to engage time-sensitive or shutdown radar systems.

The arrival of the AGM-88E AARGM represents a decisive leap over the legacy AGM-88B HARM in countering advanced Russian air defence systems such as the S-400 (NATO name: *Triumf*) the emerging S-500 Prometey, and the mobile Tor-M2 and Buk-M2 families. Earlier HARM variants were vulnerable to radar shutdown tactics, where operators deactivated their emitters once targeted to break the missile's lock.

The AARGM's GPS/INS system and passive homing receiver retain precise target co-ordinates, enabling the missile to continue toward the radar's last known position even if it goes dark. In addition, its terminal millimetre-wave radar seeker provides a final lock-on in the attack phase, ensuring lethality against mobile radars and associated command vehicles. This multi-mode guidance architecture makes the AGM-88E vastly more capable of neutralising layered, networked air defence systems designed to deny access to NATO strike aircraft.

When combined with the ASSTA 4.1 modernization of the Tornado ECR, the AARGM integration transforms the platform into a credible threat against the most sophisticated Russian anti-aircraft systems. The aircraft's updated avionics and threat libraries allow faster emitter geolocation, while the missile's advanced seeker technology improves kill probability against radars protected by electronic counter-countermeasures.

Against the S-400 and S-500 – both designed to engage targets at extreme ranges

A Tale of Two Tornado ECR Fleets

While Germany's Tornado ECR fleet remains central to NATO's electronic warfare strategy in Central Europe, Italy has developed a parallel yet distinctly different approach to the same mission set. Both nations field dedicated SEAD/DEAD squadrons operating Tornado ECR variants, but their modernisation paths, deployment doctrines, and future transition strategies reveal notable differences.

The German Luftwaffe retains a strict separation between its nuclear strike (TLG33) and SEAD/ECR (TLG51) responsibilities. The German Ministry of Defence has opted to retain the Tornado ECR for SEAD missions even as it transitions the Tornado IDS fleet to the F-35A, which will serve only as a fighter-bomber and nuclear delivery platform and not in an electronic warfare role.

In contrast, the Italian Air Force (Aeronautica Militare) operates 15 Tornado ECRs, all of which have been modernised to the RET8 'IT Full MLU' standard. With 14 of them assigned to the 155° Gruppo ETS 'Pantere Nere' of the 6° Stormo at Ghedi Air Base, these aircraft are capable of employing both AGM-88B HARM and AGM-88E AARGM missiles, as well as GBU-32 JDAMs for DEAD missions. Italy completed its AARGM Operational Test & Evaluation (OT&E) phase at China Lake in 2018 under the 'Blazing Shield' campaign, achieving two direct hits and validating the missile for frontline use years ahead of Germany.

Operationally, the Italian approach is more flexible. Italian Tornado ECR crews regularly fly joint SEAD missions with F-35A aircraft from 13° Gruppo, leveraging the fifth-generation platform's sensor fusion and electronic support capabilities. In these composite Wild Weasel packages, the F-35s act as forward electronic scouts, transmitting radar target data to the Tornado ECRs over Link 16 for long-range AARGM strikes, thus combining stealthy ISR with kinetic SEAD capacity.

Germany, by contrast, retains a more compartmentalised force structure. The F-35A, although capable of SEAD/DEAD in theory, is not tasked with that mission in the Luftwaffe. Germany instead plans to eventually transition its SEAD role to the forthcoming Eurofighter EK and until then the Tornado ECR remains Germany's only dedicated platform for SEAD/DEAD.

Training infrastructure further reflects the divergence. Italian Tornado ECR crews frequently operate from Germany's Polygone Electronic Warfare Range, conducting DEAD simulations in urban-like environments using Captive Training AARGMs. These exercises are often carried out alongside USAF F-16CM Block 50s of the 480th FS, enhancing NATO interoperability. Germany's TLG51 participates in similar training but has focused more recently on live-fire testing in the US, rather than urban radar-targeting realism.

In summary, both nations continue to rely on the Tornado ECR for their SEAD and DEAD capabilities, but Italy has taken a more integrated and expeditionary path, blending fourth- and fifth-generation assets in current operations, while Germany is maintaining its legacy doctrine until its Eurofighter EK program reaches maturity. Both strategies reflect national defence priorities, but together they ensure NATO retains a robust and complementary electronic attack capability in Europe.

Aircrew and ground personnel pose with Airbus A310 MRTT 10+26 and Tornado ECR 46+28 at Al-Azraq AB, Jordan, marking 10,000 flying hours of ISR missions under Operation Inherent Resolve on February 27, 2019
Bundeswehr/Summer

Lt Col Bjoern Jansen, deputy commander of TLG51, has logged over 5,000 hours in jet aircraft, 4,700 of them on the Tornado. He previously served as Germany's Air Attaché in Washington, DC Bundeswehr

Tornado ECR 46+25 of TLG51, one of the four aircraft involved in the AGM-88E AARGM test campaign at China Lake in April 2025 Jarod M Hamilton

and altitudes – the modernised Tornado ECR armed with AARGMs forces radar operators into a lose-lose dilemma: continue emitting and face certain destruction, or shut down and leave a critical coverage gap exploitable by NATO strike packages. This synergy between platform and missile ensures the Luftwaffe retains a decisive edge in SEAD/DEAD operations against Russia's most modern integrated air defence systems.

The AGM-88E tests in the US had four Tornado ECRs involved, 46+25, 46+28, 46+38 and 46+50 between April 2 and 28, 2025. After end of the tests, the aircraft were flown back to their home with support of a Royal Netherlands Air Force's Airbus A330-243MRTT, T-062 with a refuelling stop at Portsmouth, New Hampshire, on April 29. Except 46+28, the other three received markings of two AGM-88Es painted on the left side of their fuselages indicating test launch of six of these missiles at China Lake.

As the Luftwaffe invests in Eurofighter EK development for the long-term SEAD mission, the Tornado ECR remains Germany's spearhead in electronic warfare – battle-proven, continuously upgraded, and still unmatched within the NATO alliance for this mission set.

ASSTA 4.2 Upgrade – extending Tornado ECR life

To maintain the Tornado fleet's operational relevance amid evolving battlefield threats and increasing platform age, the Luftwaffe has implemented a series of avionics and systems upgrades under the long-running Avionics System Software Tornado in Ada (ASSTA) software standards. There was 3.1 and 3.2 and now the ASSTA 4.1 software standard is being implemented across the fleet. This phase delivers further digitalisation and system performance improvements while preserving backward compatibility with legacy mission equipment. It also enhances cockpit interface elements, refines threat libraries, and improves target engagement logic – especially relevant in SEAD/DEAD environments.

Looking ahead, ASSTA 4.2 is under development to fully support integration of the AGM-88E AARGM. This upcoming software package will likely include further avionics refinements, digital weapons interface improvements, and enhanced compatibility with emerging NATO standards in electronic warfare. Describing the recent tests in China Lake, Lt Col Bjoern Jansen, deputy wing commander and operations officer of TLG51, remarked: "We recently tested the successor of the HARM missile in the desert of California, USA. The AGM-88E has been adjusted to fit newer tactics as well as counter-tactics. Due to the changing threat and newer weapon systems, it is vital to stay up to date with the Tornado and its weapons until its operational end."

He added: "We just finished the AGM-88E campaign and we are in the middle of training another Weapon Instructor Course which will deploy on multiple occasions in order to train with our allies and partners."

One of the more visible and technically challenging changes under ASSTA 3.1 was the replacement of legacy CRT multifunction displays with AMLCD units. While these newer displays offer superior readability, reduced weight, and lower power consumption, they have introduced new points of failure due to their more sensitive digital electronics. Maintenance technicians report that while the AMLCDs reduce long-term life cycle costs, they are less rugged than their analogue predecessors and often fail more quickly—especially under extreme vibration or thermal conditions.

Compounding the strain on sustainment is the ageing nature of the Tornado airframes themselves. Many jets have exceeded 6,000 flight hours which is double their originally planned service life. Further, the Tornado's tri-national production (Germany, Italy, UK) has created a fragmented supply chain. With many subcontractors no longer in business, sourcing spare parts is increasingly difficult and expensive. Even common components often require custom manufacturing or cannibalisation from non-airworthy aircraft.

Nevertheless, through ASSTA upgrades and continued investment in sustainment, the Luftwaffe has managed to keep the Tornado fleet viable. These modernisation efforts ensure that the Tornado ECR remains not only operational but fully integrated into NATO's 21st-century electronic warfare framework.

Eurofighter EK - the Future

Although the Tornado ECR appears to perform its mission with remarkable effectiveness, its retirement is on the horizon. The Luftwaffe has selected the Eurofighter Elektronischer Kampf (EK) variant as the long-term replacement for the ECR in the SEAD/DEAD role. Built upon the versatile Eurofighter Typhoon airframe, the

A Tornado ECR of TLG51 launches an AGM-88E AARGM during a live-fire test at China Lake Test Range on April 26, 2025 Jarod M Hamilton

EK will represent Germany's first attempt to produce a dedicated electronic warfare aircraft since the Tornado ECR entered service in the early 1990s.

In November 2023, the German Ministry of Defence approved the procurement of an initial batch of 15 Eurofighter EK aircraft, which are currently being developed by Airbus in partnership with Saab. The EK variant will be outfitted with the Saab Arexis Emitter Location System (ELS) and will be capable of deploying the AGM-88E AARGM missile, thus ensuring continuity with the Luftwaffe's existing SEAD tactics and weapons inventory. These aircraft will be NATO-certified and fully operational by 2030, marking the expected end of the Tornado ECR's frontline career.

However, the EK program extends beyond merely replicating the ECR's capabilities. The Luftwaffe has already outlined a broader vision (referred to internally as "Step 2") which envisions additional enhancements such as escort jamming pods, modular payloads for different electromagnetic threats, and man-unmanned teaming (MUM-T) systems that would allow the EK to operate in conjunction with loyal wingman drones. These advanced capabilities will elevate the Eurofighter EK beyond the current scope of SEAD/DEAD, enabling it to perform full-spectrum electronic warfare in contested environments.

Until the Eurofighter EK enters operational service, the Tornado ECR remains indispensable. As the only dedicated SEAD platform in NATO's Central European inventory, it plays a critical role in suppressing enemy air defences during multinational operations and joint exercises. Its proven sensor and missile integration, continual upgrades under the ASSTA roadmap, and combat-tested doctrine make it a platform that NATO cannot yet afford to retire.

While the Tornado ECR is approaching the end of its service life, it continues to serve as a critical enabler of Luftwaffe and NATO airpower. Its eventual handover to the Eurofighter EK will mark the end of an era, but not before it completes its mission as Germany's foremost tool for electronic warfare dominance. **afm**

German Tornado ECRs in Combat ISR

While best known for their SEAD and electronic warfare capabilities, the German Tornado ECRs have also played a significant role in tactical reconnaissance, particularly during Germany's participation in Operation Inherent Resolve (OIR), the multinational campaign against Islamic State in Iraq and Syria. From 2015 to 2020, Luftwaffe ECRs equipped with the RecceLite Tactical Reconnaissance Pod carried out hundreds of intelligence-gathering sorties, providing coalition forces with crucial situational awareness and near real-time target data.

Following the November 2015 Paris terror attacks, the German parliament approved the deployment of six Tornado ECRs from TLG51 to Incirlik Air Base, Turkey, along with an A310 MRTT tanker and over 100 support personnel. Although optimised for electronic warfare and SEAD missions, the Tornado ECRs were configured exclusively for non-kinetic reconnaissance, flying over Syria and Iraq without engaging in airstrikes.

Central to these missions was the RecceLite pod, a high-performance digital reconnaissance system developed for real-time tactical ISR. Measuring 2.18m in length, 40.6cm in diameter, and weighing 215kg, the pod combines an electro-optical daylight camera with an infrared imaging system, enabling 24/7 operations across a wide range of altitudes and speeds. Thanks to its high slewing optics and multi-scan capability, RecceLite can deliver stabilised, high-resolution imagery even during aggressive manoeuvres at low and medium altitudes.

One of RecceLite's key advantages is its integrated datalink, which allows reconnaissance images to be transmitted directly to ground stations in near real time, enabling coalition analysts to assess threats or co-ordinate airstrikes almost instantaneously. The pod is mounted beneath the Tornado's centre fuselage, and its data is interpreted using a dedicated evaluation and antenna subsystem to support dynamic targeting or post-strike analysis.

Despite RecceLite's day-and-night capability, the Luftwaffe encountered technical constraints early in the campaign: the Tornado's brightly lit cockpit overwhelmed the crews' night vision goggles, initially preventing nighttime sorties. This issue was confirmed by the German Ministry of Defence and resolved within several weeks, restoring full 24-hour operational capability.

By January 2017, the deployed Tornado ECRs had completed 692 reconnaissance sorties, logging over 3,600 flight hours in contested airspace over Iraq and Syria. The aircraft routinely patrolled suspected ISIS zones, capturing imagery of vehicle movements, weapon caches, and fortified positions. When hostile activity was detected, Tornado crews would relay information to coalition strike assets to engage identified targets.

In July 2017, Germany shifted its detachment from Turkey to Al-Azraq AB in Jordan, where Tornado operations continued until March 31, 2020, when the reconnaissance mission formally ended. Although no kinetic munitions were released by the German jets, their persistent presence and intelligence-gathering capabilities significantly contributed to the effectiveness and precision of coalition air operations.

Through this mission, the Tornado ECR demonstrated its multi-role flexibility, shifting from electronic attack to high-end tactical ISR with minimal configuration changes. The RecceLite system affirmed the aircraft's relevance in modern warfare, proving that even a legacy platform can offer state-of-the-art reconnaissance support when paired with advanced sensors and communications systems.

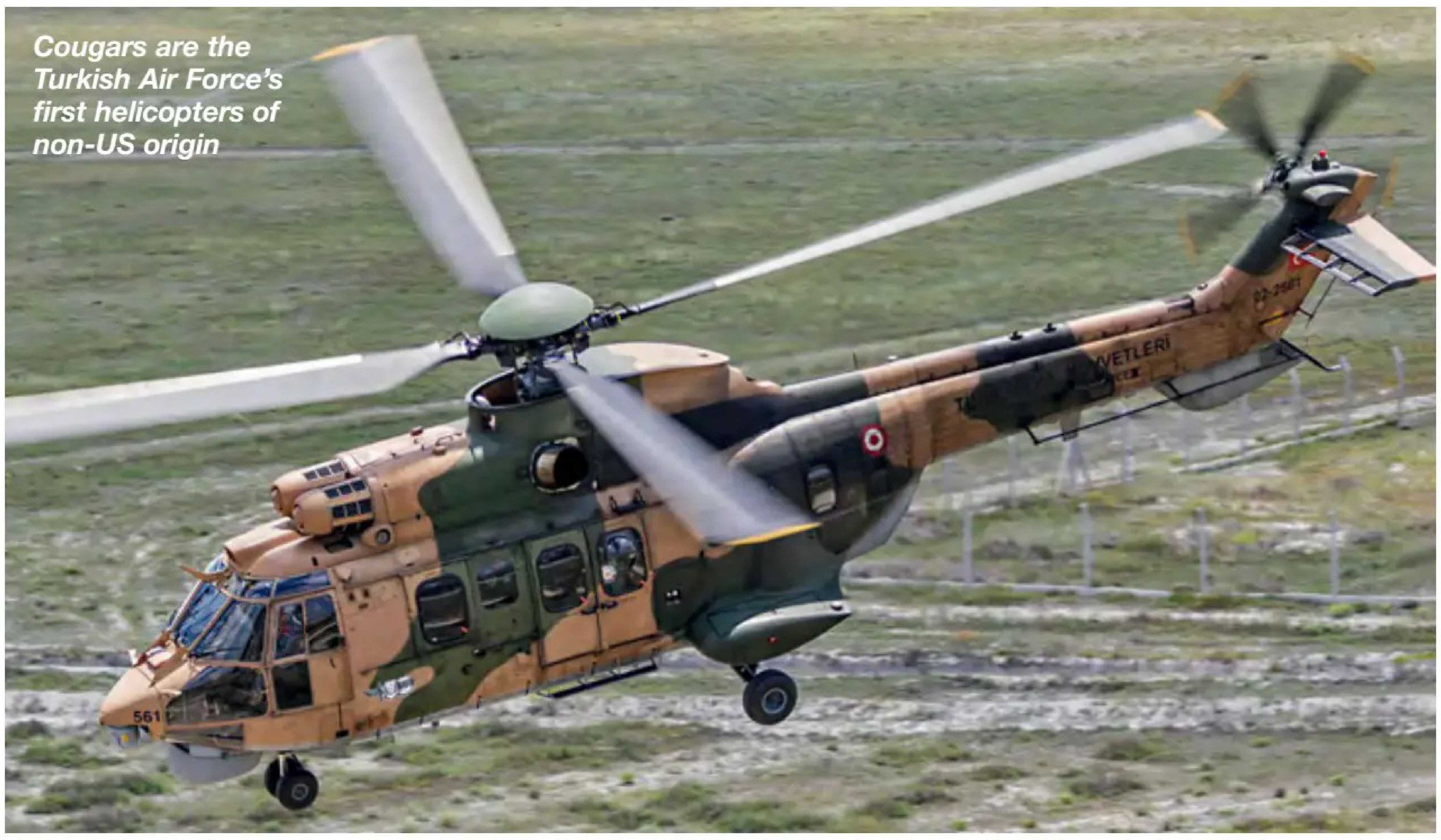
SALVATAGGIO
RESCUE
6-65
55

Just months after integrating the AGM-88E AARGM, the Italian Air Force's 155° Gruppo deployed Tornado ECR MM7055/6-65 with a CATM-88E training missile during Exercise Iniochos-19 in Greece *Babak Taghvaee*

Steel winged cavalry

Cem Doğut outlines in detail the history and current establishment of Turkey's rotary wing forces

T-70 and its escort T-129B take off. Both helicopters were produced under licence at TAI
All images Cem Doğut


Cougars are the Turkish Air Force's first helicopters of non-US origin

Turkey gained its first rotary wing capability in 1958 with the procurement of four Sikorsky UH-19D Chickasaw helicopters through the Joint United States Military Mission for Aid to Turkey (JUSMMAT) programme. A total of 18 UH-19B/Ds were procured, the start of a process which has seen the Türk Hava Kuvvetleri (Turkish Air Force - HvKK) become arguably the strongest rotary wing power in its region with an inventory comprising both direct purchases and domestic joint production programmes, the majority of which are general-purpose helicopters.

The Kara Kuvvetleri Komutanlığı (Land Forces Command - KKK) established the first Helicopter Company within the Army Aviation School Command in 1966. The initial complement of OH-13 Sioux were swiftly supplemented with AB-204B and UH-1B Iroquois purchased the same year. Seventy AB-205 helicopters procured from Italy in 1970 became the first real general-purpose helicopters of the Türk Silahlı Kuvvetleri (Turkish Armed Forces - TSK), the Turkish Air Force also introducing the UH-1H into its inventory during the same period.

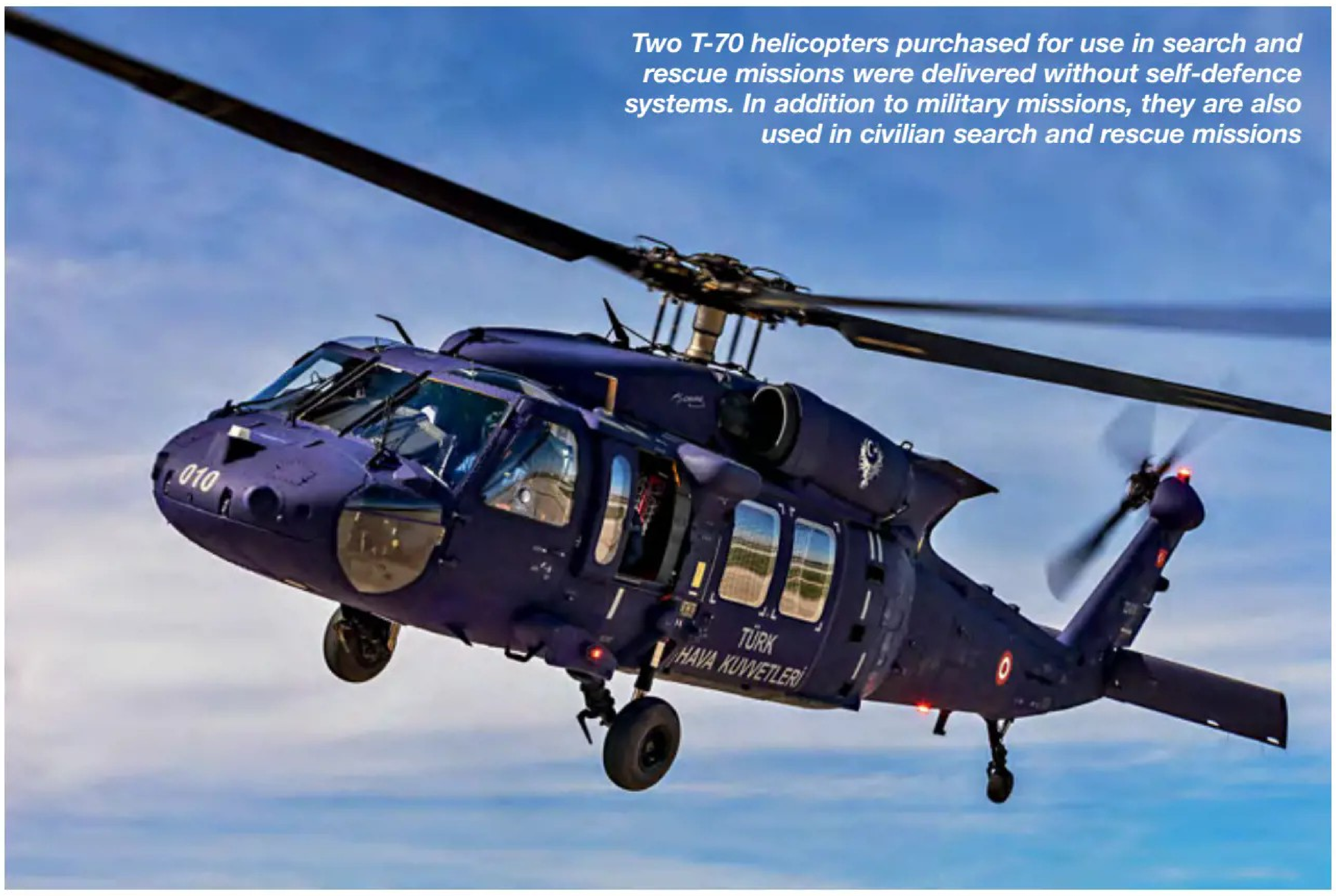
Having followed the developing technology and its own requirements the Deniz Kuvvetleri Komutanlığı (Turkish Naval Forces - DzKK) then began searching for it's own rotary wing platforms. To benefit from existing infrastructure, three AB-204B/AS were purchased in 1971 with the first helicopter delivered on October 4, 1972. These were followed by AB-212AS purchased in 1977.

Combat Debut

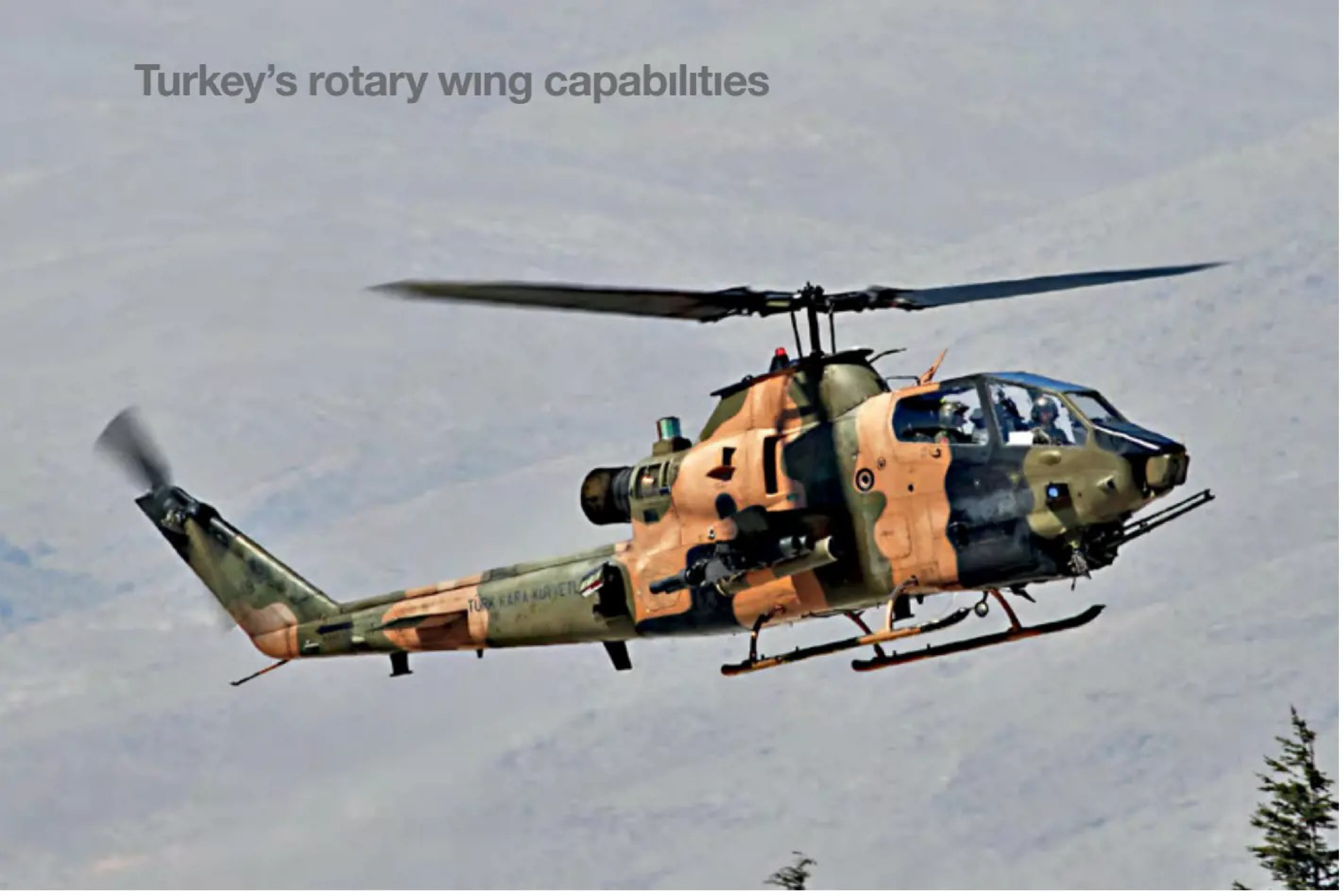
Turkey used helicopters for the first time on the battlefield in the Cyprus Peace Operation, the Turkish title for the invasion of the Mediterranean island, on July 20, 1974. On the first day of the operation, 72 helicopters of the 1st Commando Battalion of the Bolu Commando Brigade took off from Ovacık resupplying and transporting personnel to Cyprus throughout the day without any losses.

Lessons from the operation led to changes in military doctrine and a consequent re-evaluation of how helicopters could be used in addition to the existing roles of casualty evacuation, surveillance and combat.

As a result the TSK initiated work to increase the number of helicopters in its inventory, procuring 36 UH-1B and 100 UH-1D/H from the USA in 1978. The Turkish Army, which was very pleased with the Iroquois, signed an



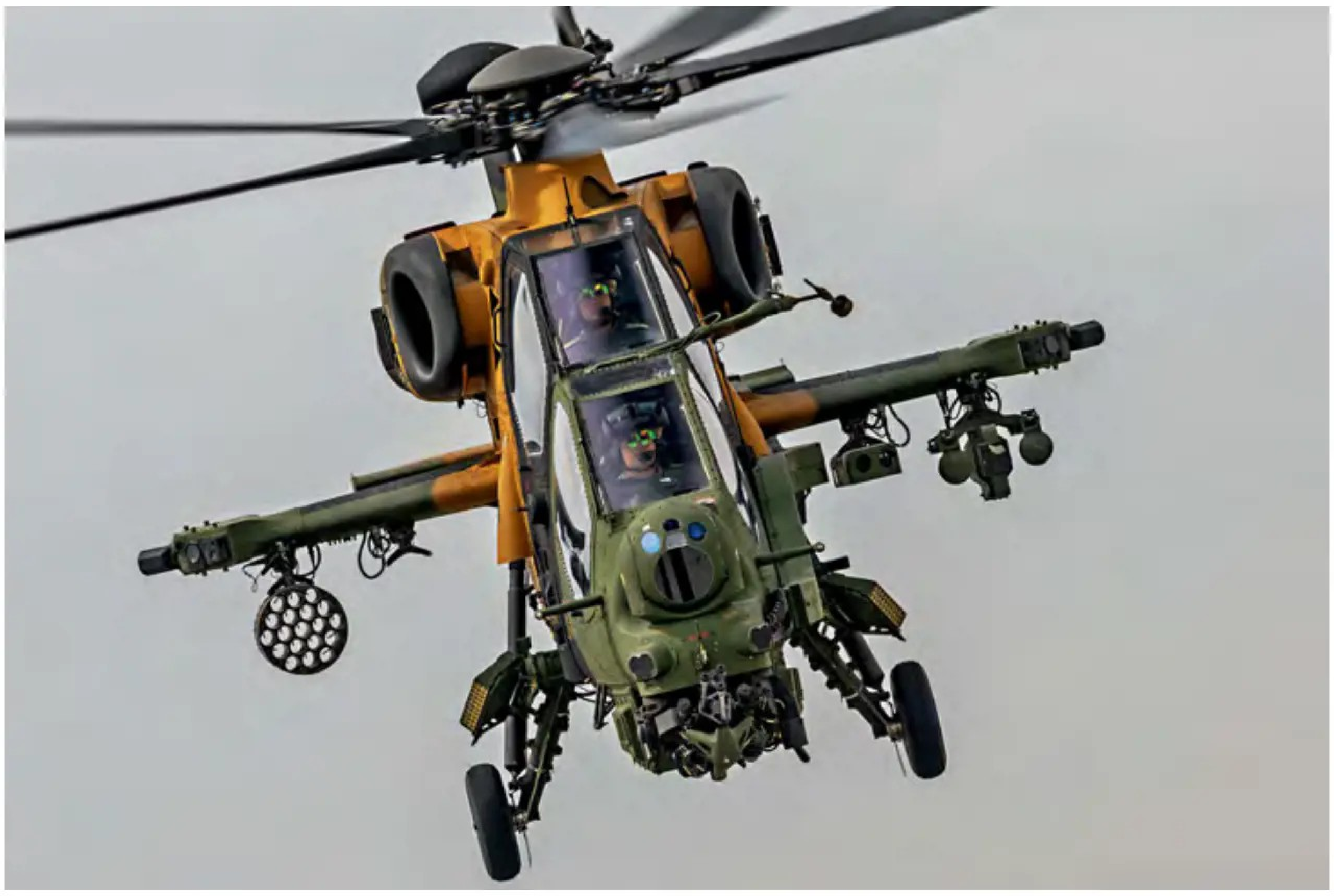
Two T-70 helicopters purchased for use in search and rescue missions were delivered without self-defence systems. In addition to military missions, they are also used in civilian search and rescue missions



Above: ***The AH-1P Cobra was Army Aviation's second attack helicopter after the AH-1W Super Cobra. While the single-engine design made them difficult to use at high altitude, they saw extensive service in counterterrorism operations.***

Right: ***T-129B showing the anti-tank UMTAS launcher on the left side next to which is the Cirit Pod. On the other wing is a 19-tube 70mm rocket pod. The empty pylon generally carries an Electronic Warfare Pod***

Below: ***A T-129B ATAK is shown with dual Cirit pods under its wing. The Cirit is a laser-guided 70mm rocket developed by Roketsan***

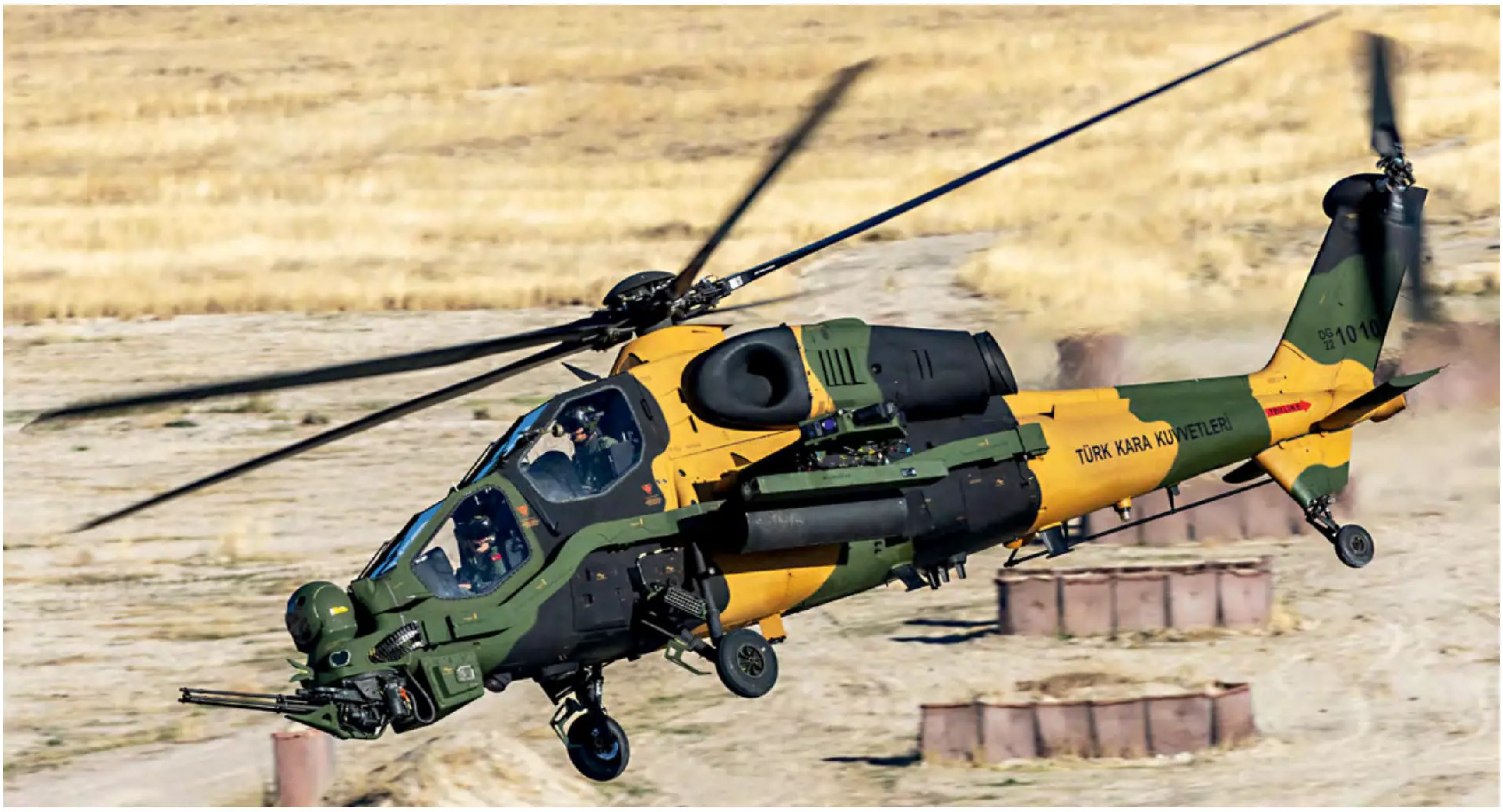


agreement with the Bell Helicopter Company in September 1982 to manufacture parts for, and assemble, 60 UH-1Hs domestically. They also gained maintenance, repair and overhaul capabilities for the helicopters.

Studies were also initiated to replace the fleets of AB-205/UH-1H helicopters with a new generation platform to meet operational needs in the 2000s. On August 1989, the Savunma Sanayi Müsteşarlığı (Undersecretariat for Defense Industries - SSM) issued a request for proposals for the manufacture of at least 200 general-purpose helicopters. SSM selected the Sikorsky S-70 in September 1992.

The Turkish Armed Forces were no stranger to the Black Hawk as six S-70A-17s were ordered by the Jandarma Genel Komutanlığı (Gendarmerie General Command - JGK) in 1988, entering the inventory at the end of the same year. The following year, six examples were also purchased for the Police Aviation as an urgent operational requirement.

On December 8, 1992, an agreement was signed with Sikorsky for 95 S-70A-28 Black Hawks, 50 of which were to be jointly produced. The ready-made purchase package was completed with the delivery of the final five S-70A-28s in May 1994. Unfortunately, joint production of the 50 units could not be realised due to financial difficulties.



Turkish S-70s are among the best equipped Black Hawks in the world featuring advanced RWR, MWS, LWS, and RJ systems for self-defence

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TEHLİKE
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Fleet diversification

Negotiations for military equipment purchases held with the Russian Federation, which owed Turkey a Türk Eximbank loan, between 28-31 October 1992, resulted in the purchase of Mi-17 *Hip* helicopters for the JGK. A contract was signed for the direct purchase of 19 Mi-17-1VS in November 1993 , two of which equipped as air ambulances.

Political problems with the United States saw Turkey seek alternative partners for joint production leading to the direct purchase of 20 AS 532UL Cougar Mk1s from Eurocopter for the KKK on February 28, 1993. Signed in September that year, the Phoenix-1 contract saw the first helicopters delivered in 1995. A further 20 Cougars were ordered to replace the ageing UH-1Hs in the SAR role with the Turkish Air Force including six equipped for Combat Search and Rescue (CSAR). Ten AS 532UL Cougar Mk1 helicopters were also added to this package for operation by the KKK.

Part production, final assembly and flight tests of the helicopters were undertaken in Turkey at TAI (Turkish Aerospace Industries) facilities. The Phoenix-2 contract was signed with the EuroTAI Consortium formed by Eurocopter and TAI on February 13, 1997. Delivery of the first helicopters commenced in 2000 and the project was completed in 2003.

A second agreement was signed with Sikorsky Aircraft on February 3, 1999, for the ready purchase of 50 S-70s. The first 20 of the order delivered were the S70A-28 Black Hawk model in production for the United States Army, the remaining 30 were delivered as the S-70A-28D model with a digital cockpit. The first 20 Black Hawks of the order were subsequently upgraded to ‘D’ model standard.

Eight S-70B-6 Seahawk helicopters were ordered for the DzKK to be used in the Anti-Submarine Warfare role pursuant to an agreement signed February 19, 1998. The helicopters were delivered in 2002. On June 24, 2005, an agreement was signed for a second purchase of 16 helicopters. Due to the delay in deliveries, Sikorsky delivered an additional Seahawk free of charge as a penalty.

Meanwhile the Sahil Güvenlik Komutanlığı (Coast Guard Command - SGK) signed a contract with Agusta on March 20, 1998, for

Below Left: **To assist helicopter pilots landing on rocky terrain, a technician leans out of a window to guide them.**

Below: **The veteran UH-1Hs are now used exclusively for training missions, leaving general purpose missions to the Black Hawks and Cougars**

the purchase of AB-412EP SAR helicopters with 14 helicopters ordered in three packages.

Heavy Lift Helicopter Project

In July 2007, an official letter of request was submitted to the US government to purchase ten CH-47F Chinooks and the Foreign Military Sales process initiated.

The initial requirement was increased to 14 to include the needs of the Özel Kuvvetler Komutanlığı (Special Forces Command - ÖKK). Although an agreement was signed in 2011, due to budgetary constraints, the order was reduced to six aircraft. However, an agreement for a second package of five CH-47F orders was made in 2015. The first six Chinooks were delivered in 2016 and the remaining five delivered in 2019. Seven now serve in the KKK and four in the ÖKK.

Turkish Light Utility Helicopter Programme

With the aim of meeting the general-purpose helicopter needs of the Turkish Armed Forces and other authorities with an indigenous platform, the Turkish Light Utility Helicopter (TLUH) Procurement Programme led to a contract being signed with TAI on June 26, 2013, for a light utility helicopter. The T625 Gökbey twin-engined light transport and utility helicopter made its maiden flight on September 6, 2018, with the first delivery, to the Jandarma Havacılık Başkanlığı (Gendarmerie Aviation Directorate), on October 29, 2024. In the first phase 20 helicopters will be procured with a requirement identified for an additional 112 examples to meet domestc needs.

Powered by the TS1400 engine developed by TEI, the T625 has a total take-off weight of six tons and passenger capacity of 12 (ten in military configuration). It has a maximum speed of 306km/h, a service ceiling of 20,000ft and an endurance of 3.8+ hours, extended to over five hours with external fuel tanks with a maximum range of 948km.

Above: ***CH-47F Chinook helicopters serve as the Army Aviation's heavy-lift helicopters. Although based in Ankara, they play a crucial role in providing logistical support to ground units in Turkey and beyond the border***

Below: ***Fourteen AB-412EP SAR helicopters are operated by the Coast Guard***

Above: ***Because the Gendarmerie is responsible for combating terrorism domestically, it utilises T-129B ATAKs to provide fire support to its own units. Like the S-70s, the Gendarmerie ATAKs are plain green***

Left: ***A Mil-17-1VS flies in formation with a JGK S-70A-17***

Below: ***The Navy uses two AB-212s for general purpose missions, now flying in plain grey instead of this former camouflage colour scheme***

Turkish Utility Helicopter Programme

A second programme, the Turkish Utility Helicopter Programme (TGMHP), was initiated with the aim of meeting the general-purpose helicopter needs of TSK and public institutions through a model produced under licence in Turkey. A contract for the delivery of 109 T-70 helicopters was signed between the Undersecretariat for Defense Industries and the Prime Contractor TAI on February 21, 2014.

Based on the S-70i International Black Hawk, the new helicopters will be produced in Turkey over a ten year period under prime contractor TAI and prime subcontractors Sikorsky and Aselsan.

The Black Hawk adventure, which began with the first S-70A-17 received by the Gendarmerie General Command in December 1988, continues with the first T-70 produced by TAI delivered to the Gendarmerie General Command on December 13, 2022.

Attack Helicopters

Military operatons in southeast Turkey against Kurdish insurgent groups saw the requirement emerge for a helicopter to provide close air support to personnel in the field. Mounting external weapons on existing platforms had proven ineffective and the decision was therefore taken to aquire a dedicated attack helicopter. In consequence, five AH-1W Super Cobras were purchased under an urgent

Above: ***Police T-129Bs conduct firing training with 20mm M197 guns, their sole weapon***

Above left: ***Police Aviation recently took delivery of its fourth T-70. Police Aviation will gradually replace its ageing Black Hawk fleet with T-70s and Gökbeys***

operational requirement in January 1990 and delivered to the KKK later the same year.

Following the completion of training and infrastructure preparations, two AH-1Ws were transferred to Diyarbakır on March 24, 1991 to take part in anti-terror operations. As the nature and course of the ongoing struggle in the area evolved, an order for a further five AH-1s was placed in 1993 with all of the helicopters delivered in 1994.

The TSK continued to bolster its armed helicopter fleet and within the scope of the US Southern Wing Assistance, it added the 28 AH-1P, 12 AH-1S and four TAH-1P helicopters offered in May 1992 to its inventory. While the TAH-1Ps were used for training purposes, the AH-1Ss were used as a source of spare parts. These helicopters were delivered to the KKK between 1993-1995.

In due course, as the number of T129B ATAK helicopters increased, the AH-1Ps were removed from the inventory before the Army transferred their AH-1Ws to the Navy.

ATAK Programme

Work initiated in 2005 to renew the attack helicopter fleet gained momentum in 2007 with the selection of the AgustaWestland A129 Mangusta helicopter. Within the scope of the ATAK Programme, TAI assumed the responsibilities of main contractor while Aselsan and AgustaWestland acted as main subcontractors. The T129 ATAK helicopter, based on the A129, uses two

Below: ***A S-70B Seahawk, the Navy's primary ASW helicopter, being prepared for takeoff at Cengiz Topel, the headquarters of the Naval Aviation Corps***

LHTEC CTS800 4A turboshaft engines, each capable of producing 1,360shp. It has high manoeuvrability and flight stability with its domestically designed and produced digital cockpit architecture, mission computers and advanced flight and fire control systems.

Within the scope of the T129 ATAK programme, the production of 124 T129s is planned, of which 92 (59 KKK, 24 JGK and nine police) are definite and 32 optional for the KKK.

Police Aviation

To increase the effectiveness of the police in the areas of public order, traffic, smuggling and first aid, the Emniyet Genel Müdürlüğü (General Directorate of Security - EGM) Aviation Department was established on October 19, 1981, with 18 second-hand Alouette SA-318C reconnaissance and surveillance helicopters supplied from Germany.

A requirement for 15 twin-engine light utility helicopters for use in reconnaissance and surveillance missions by the EGM Aviation Department led to the selection of the Bell Helicopter Textron 429 with a contract signed on March 6, 2012. All are equipped with Star Safire 380-HD FLIR System, megaphone and searchlight equipment.

There are currently seven S-70, three T-70, 14 Bell 429 and three T-129B in the Police Aviation inventory. **afm**

Special Forces Black Hawks can extend their range thanks to their external fuel tanks

Bases, units and equipment

Turkish Air Force

Base	Unit	Type
Izmir-Kaklıç	125. Filo	AS532UL, UH-1H
Eskişehir	201.Filo	AS532UL/AL
Konya	135. Grup Komutanlığı	AS532UL/AL, T-70, UH-1H
Diyarbakır	202. Filo	AS532UL/AL
Merzifon	203. Filo	AS532UL/AL

Turkish Army

Base	Unit	Type
Ankara-Güvercinlik	Yük Helikopter Taburu	CH-47F
Ankara-Güvercinlik	Hava Ulaştırma Grup Komutanlığı	S-70, AS532UL
Isparta	Kara Havacılık Okulu	UH-1H, AB206, AW119Kx, AB205
Isparta	1. Kara Havacılık Alayı	S-70, T-70, T129B
Malatya-Tulga	2. Kara Havacılık Alayı	S-70, AS532UL, T129B
Izmir- Gaziemir	3. Kara Havacılık Alayı	S-70, AS532UL
Istanbul-Samandıra	4. Kara Havacılık Alayı	S-70, AS532UL, AB205, UH-1H
Diyarbakır	7. Kara Hava Grup Komutanlığı	S-70, AS532UL, T129B

Jandarma

Base	Unit	Type
Ankara-Güvercinlik	Jandarma Havacılık Okul Komutanlığı	AB-205, S-70
Ankara-Güvercinlik	Ankara Jandarma Hava Grup Komutanlığı 1. Filo	S-70A, T-70
Ankara-Güvercinlik	Ankara Jandarma Hava Grup Komutanlığı 2. Filo	S-70, Mi-17-1V, T625
Aydın	Aydın Jandarma Helikopter Filo Komutanlığı	S-70, Mi-17-1V
Diyarbakır	Diyarbakır Jandarma Hava Grup Komutanlığı 1. Filo	S-70
Diyarbakır	Diyarbakır Jandarma Hava Grup Komutanlığı 2. Filo	S-70
Diyarbakır	Diyarbakır Jandarma Hava Grup Komutanlığı Taarruz Helikopter Filosu	T129B
Van	Van Jandarma Hava Grup Komutanlığı	S-70, Mi-17-1V, T129B

Navy

Base	Unit	Type
Kocaeli-Cengiz Topel	351. Deniz Helikopter Filosu	S-70B, AB212ASW
Kocaeli-Cengiz Topel	353. Deniz Taarruz Helikopter Filosu	AH-1W
Muğla-Dalaman	352. Deniz Helikopter Filosu	S-70B

Coast Guard

Base	Unit	Type
Antalya	Sahil Güvenlik Antalya Hava Grup Komutanlığı	AB412EP
Izmir-Adnan Menderes	Sahil Güvenlik İzmir Hava Grup Komutanlığı	AB412EP
Samsun-Çarşamba	Sahil Güvenlik Samsun Hava Grup Komutanlığı	AB412EP

Police

Base	Unit	Type
Adana-Şakir Paşa	Yıldızhan Filo	Bell 429
Ankara-Ufuk Danışmend	Oğuz Filo	Bell 429, S-70, T-70, AB206, T129B
Antalya	Ayhan Filo	Bell 429
İstanbul-Atatürk	Denizhan Filo	Bell 429, S-70
İzmir-Adnan Menderes	Gökhan Filo	Bell 429
Diyarbakır	Dağhan Filo	Bell 429, S-70
Van	Günhan Filo	S-70

ROYAL AIR FORCE
ZH899
RESCUE

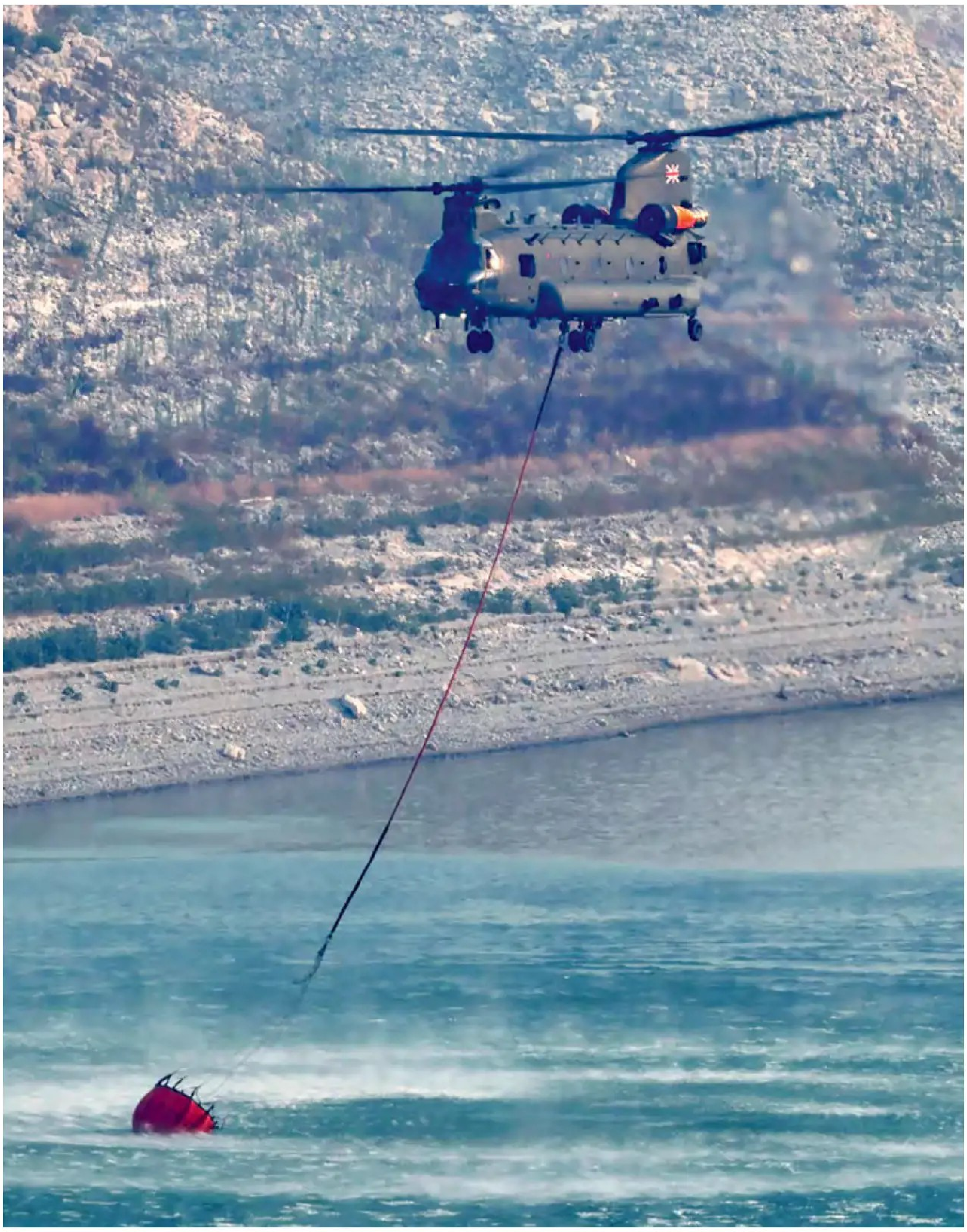
Combat to Containment

Babak Taghvaee watched military aircraft extinguishing ferocious wildfires in Cyprus this summer

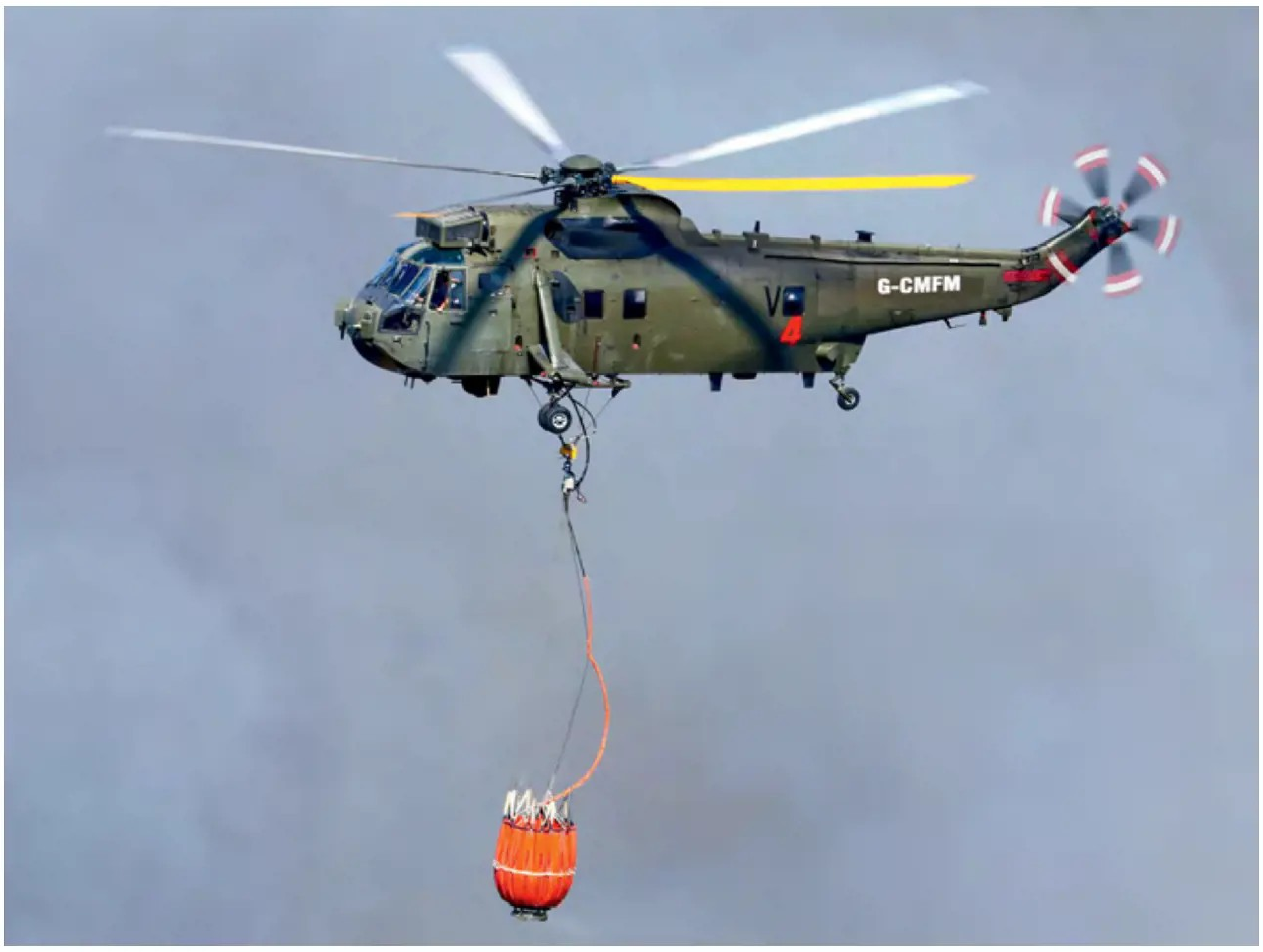
The skies over Cyprus roared with the sound of rotor blades and turboprop engines in late July 2025, not from military exercises but from an extraordinary international effort to contain one of the worst wildfires in the island's history.

From July 23 to 26, raging fires driven by record-high temperatures, prolonged drought, and dry mountain winds swept across the Troodos foothills and Limassol and Paphos districts. With Cyprus's own aerial firefighting fleet crippled by maintenance issues and procurement delays, the government activated bilateral and EU support protocols, triggering an unprecedented multinational response led by military and civil aviation assets from the UK, Israel, Jordan, Egypt, and others.

The RAF's 1310 Flight at RAF Akrotiri operates a single Chinook HC5, ZH899, which was the first to be deployed during the initial phase of the firefighting effort near Limassol on July 23, 2025. It is seen here arriving over the active fire zone All photos, author



Four Chinook HC6As are assigned to 1310 Flight at RAF Akrotiri one from 18(B) Squadron and three from 27 Squadron. Chinook HC6A ZH776 is captured here conducting a water pickup from the Kouris Dam during early morning firefighting operations



UK contribution

For the first time, RAF Chinooks were employed in an active firefighting role over Europe (see *AFM* September p74-75). Chinook HC5 ZH899 and HC6A ZH776, both from 18(B) Squadron at RAF Odiham but on deployment at RAF Akrotiri as part of 1310 Flight, were rapidly reconfigured to carry 2,000-litre Bambi Buckets and flew multiple suppression sorties over smoke-choked valleys near Vouni and Agios Therapontas. Their heavy-lift capabilities, endurance, and agility enabled precise water drops along mountainous terrain inaccessible to ground crews. Co-ordinated through the Joint Air Delivery Test and Evaluation Unit, the Chinooks also ferried equipment and supplies to isolated villages cut off by fire. Their successful deployment marked a milestone in the RAF's operational

Left: ***Only two of the original 42 Sea King HC4s built for the Fleet Air Arm remain airworthy. One of them, G-CMFM (formerly ZF122), is operated by Heli-Lift Services in Cyprus. Due to strict non-disclosure agreements, aircrew were reluctant to discuss their civilian firefighting missions with the author***

The Junglie of Heli-Lift Services, G-CMFM (formerly ZF122), can be seen dropping water on a wildfire near Limassol on July 24

Slovak Training Academy deployed two former US Army EH-60A Black Hawks, modified for firefighting operations, from Paphos. One example, OM-BHC, is pictured dropping water on a wildfire near Omodos using an external Helitak tank

doctrine, showcasing the Chinook's ability to transition from tactical lift and special operations support to humanitarian and disaster relief missions.

Adding to the UK contribution was the civilian-operated Westland Sea King HC4+ G-CMFM. Formerly ZF122, a Commando Helicopter Force veteran (previously used by the Fleet Air Arm), this aircraft was restored by Historic Helicopters (UK) and repurposed by Heli-Lift Services (UK) for aerial firefighting. Flying from Andreas Papandreou Air Base, G-CMFM executed its first fire suppression mission on July 23, becoming the only Sea King HC4+ in active civilian service. Alongside Sikorsky S-61N Mk.II N627CK, the Sea King flew continuous sorties, dropping water in areas where fixed-wing aircraft could not safely operate due to terrain or smoke. Veteran British aircrews with military and SAR

Two AT-802F Fire Boss aircraft from the Royal Jordanian Air Force's 25 Squadron, based at King Abdullah II Air Base, have been supporting Cyprus's Forestry Department firefighting efforts from Larnaca for the past two years

One of two Egyptian Air Force CH-47D Chinooks deployed to Cyprus is seen departing Andreas Papandreou Air Base in Paphos for an evening firefighting sortie near Limassol

experience piloted G-CMFM, reinforcing the value of retrofitted military platforms in civil emergency operations.

Dropping at night

The Israeli Air and Space Force's (IASF) role was pivotal. On July 24, two C-130J-30 Shimshon aircraft, 663 and 667, deployed from Nevatim Air Base to conduct the first operational use of the Guardian containerised firefighting system in Cyprus. Developed by Caylym Technologies, the Guardian system uses recyclable cardboard containers filled with Class A foam, designed for low-level airdrops. The 32 containers fell over the Alassa and Vouni fire fronts and helped halt the fire's progression towards residential areas. Remarkably, the mission was carried out at night using the Shimshon's terrain-following avionics.

According to Caylym's Managing Director, Rick Goddard, "Our involvement with the Cyprus mission centred around the ability to pre-fill and pre-stage Guardians to accelerate the reload and drop cycle… the high payload-to-system weight ratio and 24-hour operability proved a true force multiplier for incident commanders." The success of the airdrop validated the Shimshon's dual-use capability in both military and disaster relief operations.

The Royal Jordanian Air Force (RJAF) deployed two AT-802F Fire Boss aircraft, 2560 and 2561, along with two UH-60M Black Hawks for water bucket operations. The Fire Boss aircraft operated from Larnaca International Airport and flew in co-ordination with Cypriot and leased SEATs (Single Engine Air Tankers) from Argentina, Australia, and Chile. The Black Hawks conducted mop-up operations and flare-up suppression on July 25 and 26, working in rugged terrain unsuitable for fixed-wing drops.

Meanwhile, the Egyptian Air Force's contribution came in the form of two CH-47D Chinooks, 3001 and 3015, which operated out of Paphos International Airport. These helicopters flew in tandem with RAF Chinooks and civilian operators, delivering multi-ton water drops and ferrying emergency personnel into otherwise inaccessible regions. Their performance was particularly crucial during high-wind phases of the operation, when precision and endurance were required to maintain control of containment lines.

Unable to meet challenge

The Republic of Cyprus's own fleet was unable to meet the challenge. The Forestry Department's fixed-wing aircraft –Thrush 550P FD-2 and AT-802F FD-1 – were grounded due to maintenance. Their absence left the country entirely reliant on foreign assets. On the rotary-wing side, the National Guard and Police Aviation Unit had only two Bell 412s (CP-2 and CP-4) available, with just one of their five AW139s airworthy and four of their H145Ms, originally meant for anti-tank and attack roles, reassigned to firefighting command duties.

Historically, Cyprus had filled gaps in capacity by leasing aircraft, primarily AT-802Fs from international operators. This season's reinforcement included five aircraft from Australia's Central Highlands Aerial Services, one from Argentina's Helicópteros del Pacífico, and one from Chile's CONAF. These aircraft flew hundreds of sorties across diverse terrains, co-ordinated through the Forestry Department and RJAF, and were instrumental in fixed-wing suppression operations. Though technically temporary, these assets functioned as an extension of Cyprus's own force, proving indispensable to the success of the multinational campaign.

The fires destroyed over 120sq km of forest and farmland, killed two civilians, and hospitalised at least 50 others. Infrastructure damage included the loss of 300 power pylons and dozens of homes. Entire villages like Louvaras and Dhoros had to be evacuated. President Nikos Christodoulides later admitted to failures in Cyprus's emergency readiness and pledged compensation and major reforms, including acquiring new fixed-wing aircraft and placing all national firefighting aviation under the National Guard's operational control.

The multinational response to the July 2025 wildfire crisis in Cyprus showcased the critical role of military aviation in civil emergencies and highlighted the dangers of neglecting national aerial firefighting readiness. The successful integration of British Chinooks, Israeli Shimshons, Jordanian Black Hawks and Fire Bosses, Egyptian Chinooks, and international civilian SEATs represented a new level of coalition co-operation in the face of climate-driven natural disasters. Whether Cyprus can rebuild and reform its own fleet in time for the next fire season remains to be seen but this unprecedented operation has set a new standard for multinational aerial disaster response. **afm**

Thanks to the Wescam MX-15 EO/IR imaging system installed under their noses, two C-130J-30 Shimshon tactical airlifters of the 103th 'The Elephants' Squadron, including this example (667), effectively dropped foam contained boxes over the Cyprus wildfire at night

Italian STOVLs in France

Brittany was the attractive setting for a joint naval and air force exercise featuring Italian STOVL Harriers and Lightnings, with the French Rafales. **Frederic Lert** explains what was going on

MARINE
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MARINA

Not far from Landivisau, the French Brittany coastline provides a dramatic backdrop for this formation flying with a Rafale M and an Italian Navy F-35B. The F-35B cockpit appears to be roomier than the Rafale's *Anthony Pecci*

It was an unusual sight in Landivisiau, under a bright sun with local farmers busy collecting bales of hay around the runways and taxiways. Eight Italian short take-off and vertical landing (STOVL) aircraft made the trip from the Grottaglie and Amendola Air Bases (AB). They were made up of four F-35Bs and two AV-8Bs from the Gruppo Aerei Imbarcati (GRUPAER) 'Wolves' of the Italian Navy and two F-35Bs from the 101st Gruppo of the Italian Air Force (Aeronautica Militare, AM), which was reactivated on July 1. The Italians also had ambitions of bringing a two-seater TAV-8B, but a last-minute breakdown dashed those ambitions.

Even though they don't practice 'cross-decks' yet between aircraft carriers, the two naval air forces know each other well. In May 2024 they worked together during the Mare Aperto/Polaris exercise, and four Rafale Ms were deployed to Grottaglie. More recently, in early 2025, three Rafale Ms made a stopover in southern Italy during the Clemenceau Mission.

"We share with the French naval aviation the same vision of the use of a Carrier Strike Group [embedded air group]," explained Commander Giambattista 'Giamba' Molteni, head of the Italian Navy fighter squadron (GRUPAER) and frigate captain. "We worked together and it worked very well; we learned a lot in terms of mutual support within a flexible organisation."

Following the first exchanges, invitations were sent and the Italians were invited to train at Landivisiau, Brittany, northwestern France. "OK" was the prompt reply from GRUPAER and the deal was done during the first half of July. The Italian detachment included the eight aircraft, about a 100 personnel, including 15 pilots, the jets being placed under the direction of Molteni. With more than 6,000 flight hours experience on fighters and other aircraft including 2,600 hours on AV-8Bs and 300 on F-35Bs, with 15 years of experience as a test pilot and active participation in the development of the Joint Strike Fighter (JSF) 1999 VAAC (Vectored Thrust Aircraft Advanced Control) program, the pilot has a fine pedigree in STOVL fighters.

LES LOUPS SUR LANDIVISIAU - GRUPAER DET

The exercise patch *Frederic Lert*

Sharing roles

The Italian Navy currently operates eight F-35Bs, with the goal of the fleet to have at least 20 aircraft. The AM operates 22 conventional take-off and landing F-35As and, for the time being, only two F-35Bs within the Amendola-based 32nd Stormo. The Italian system is therefore unique, in that the Air Force and Navy share the use of STOVL aircraft on the *Cavour* aircraft carrier.

"We first tested this system during our deployment to the Indo-Pacific," explained Molteni. "Upon returning from Exercise Pitch Black in Australia, we embarked the two AM aircraft alongside 13 of our mixed

AV-8B and F-35B crews pose for the camera. The F-35's helmet, second and fourth from the left, are said to be efficient and comfortable *Anthony Pecci* fleet of F-35Bs and AV-8B on the *Cavour*. Six AV-8Bs and one TA-V8B were also involved, resulting in a powerful carrier group of around 20 aircraft. This first co-operation between the two branches yielded very good results."

The Italian carrier air group remains under the sole command of a naval Captain, in the same way that the carrier strike group is under the responsibility of an Admiral. The AM provides additional human and materiel resources, which are then added to the Carrier Strike Group Air Wing for the time at sea. The lead is assigned to the navy when the mission is performed by embarked elements on the *Cavour*, and eventually assigned to the AM when developed in a land-based context.

"Our primary mission is projection from the sea, force protection, and air defence of the fleet at sea," Molteni continued. "On interdiction missions, the AV-8Bs are fully integrated into F-35B operations in Fighter Integration CONOPS [Concept of Operations] via the Link 16 data link. The two aircraft also complement each other in terms of weapons carried: although JDAMs are in both aircraft's inventory, the Harrier can carry the Joint Stand Off Weapon [JSOW], not available yet on the F-35B. Conversely, the F-35A is equipped with the GBU-39 Small Diameter Bomb (SDB) while the F-35B is about to receive a similar improved capability, when, by the end of the year, the fleet will move to the TR3 update with the new software standards supporting SDB2 net-enabled weapon – a standard that will offer us a very large potential for development in the years to come. We are also talking about the integration of the Meteor air-to-air missile or a long-range SEAD weapon. Another capability that the Italian Navy is working on for its F-35B is buddy-buddy refuelling on the Super Hornets (a capability already available on the AV-8B) and why not one day on the Rafales."

The Harrier question

The Italian Navy's goal is to maintain its Harrier fleet for few more years; 2028 or perhaps 2030. Much depends on the US AV-8B program, which forms the cornerstone of the aircraft's operation and which announced the retirement from USMC service next year. The world's other two users, Italy and Spain, are somewhat dependent on the American pace. While Italy has prepared its transition to the F-35B, things look more complex for Spain, which recently ended discussions in purchasing the American aircraft, even though it is the only possible option for maintaining its air force aboard the aircraft carrier *Principe de Asturias*. On the Italian side, maintaining two fleets simultaneously, results in the presence of two pilot populations. However, the Italians have made a bold choice over the past three years to retain pilots with dual qualifications on both aircraft.

"It was important to keep both aircraft, to have a sufficient number of aircraft while waiting for the F-35 community to grow," Molteni said. "We quickly realised that to maintain this number and remain operational with sufficient aircraft and pilots, we needed dual-qualified pilots."

Eight pilots have the most experience, and therefore the ability, to operate on the AV-8B and the F-35B, which share the same STOVL regime, but respond to completely different piloting logics. The requirements for the dual qual was to have at least around 1,000 hours of experience on the Harrier before taking possession of the F-35B. The transition to the F-35B is very well structured and operates seamlessly, despite the generational gap between the two

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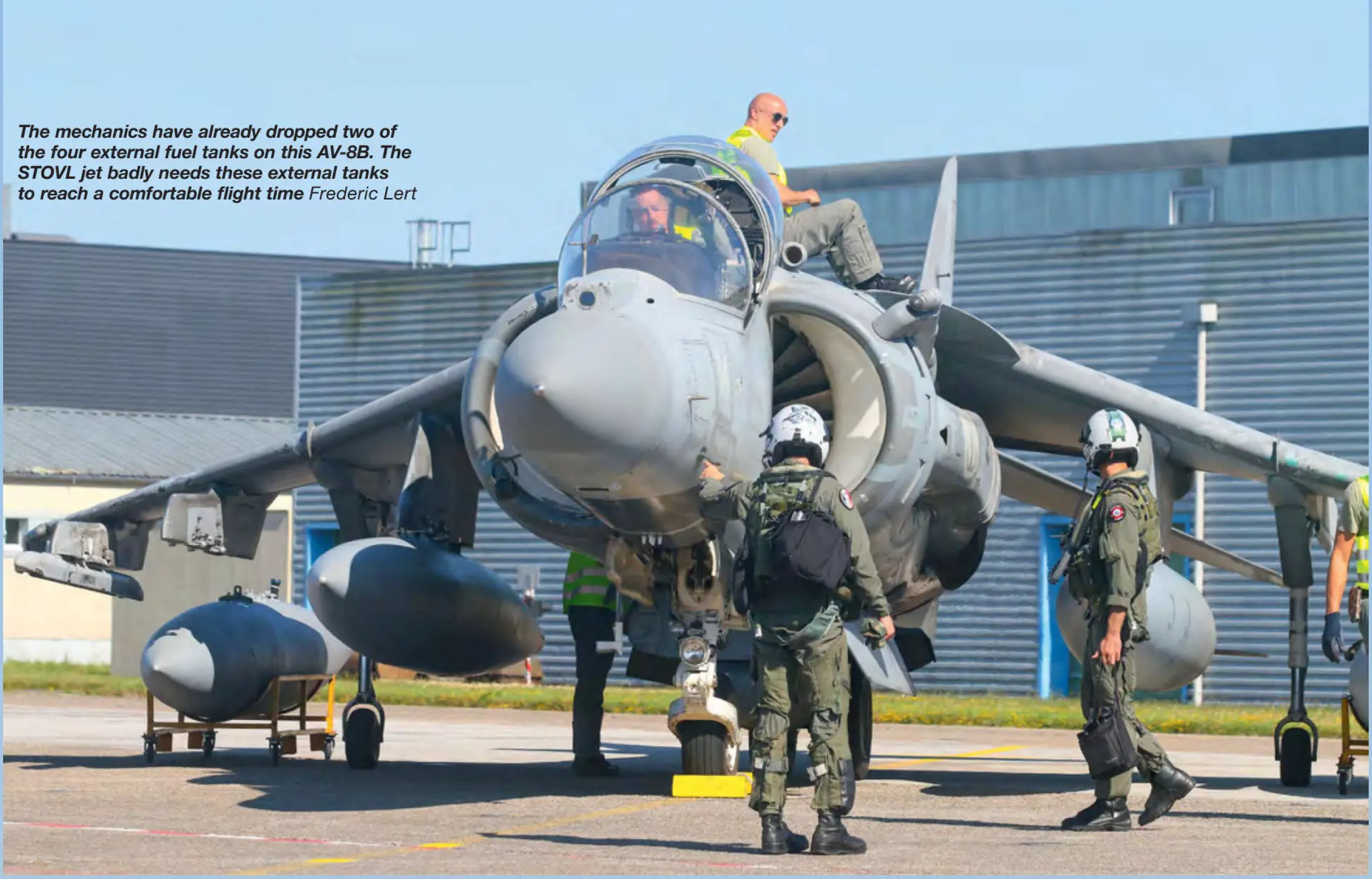
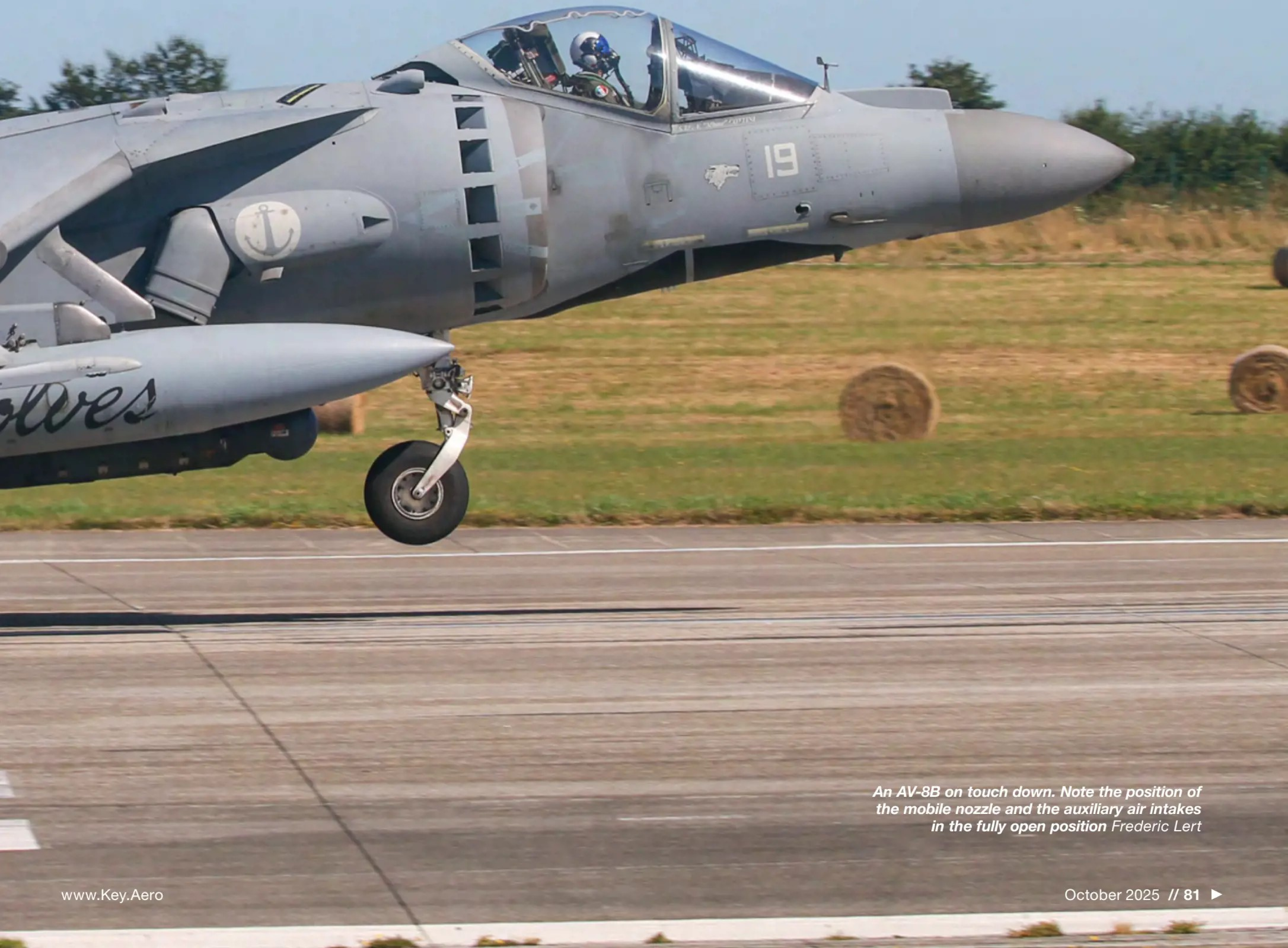


The mechanics have already dropped two of the four external fuel tanks on this AV-8B. The STOVL jet badly needs these external tanks to reach a comfortable flight time Frederic Lert



An AV-8B on touch down. Note the position of the mobile nozzle and the auxiliary air intakes in the fully open position Frederic Lert

A fake canopy is painted under the AV-8B's fuselage, a cheap way to confuse the opponent in a dogfight *Anthony Pecci*

MARINA
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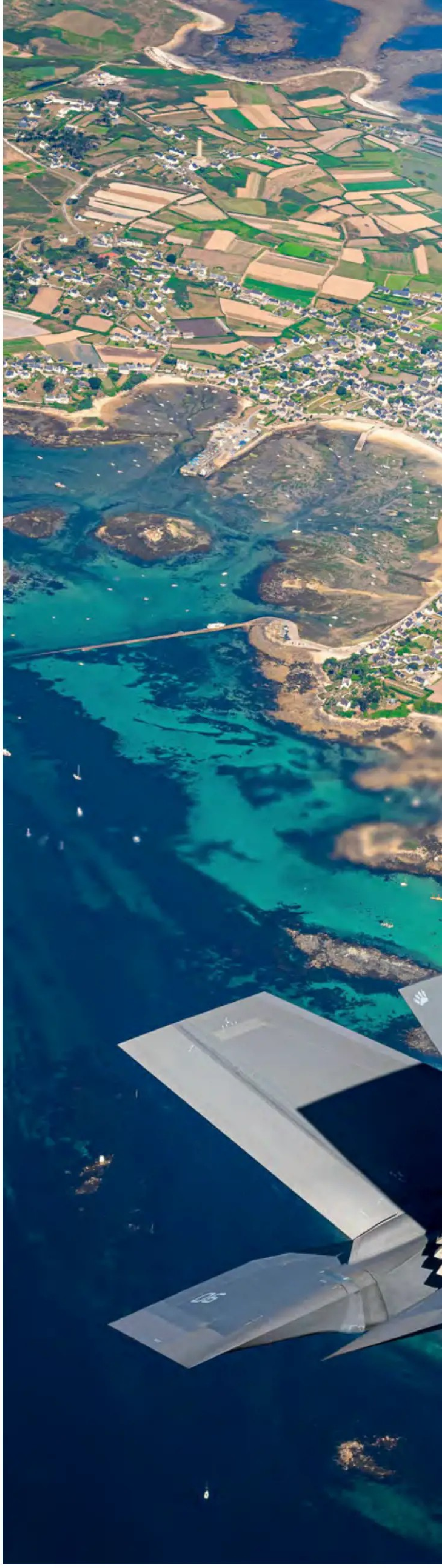
SY HOURS

The Italian Air Force operates 22 conventional take-off and landing F-35As and, for the time being, only two F-35Bs within the Amendola-based 32nd Stormo *Frederic Lert*

A unique formation flight featuring three generations of combat aircraft, from the AV-8B to the F-35. The Rafale is the only one fitted with an arresting hook *Anthony Pecci*



aircraft, the return to the AV-8B is a natural effort for an experienced Harrier aviator. Once qualified on both aircraft, pilots can switch from one to the other overnight. Strict use of best practices, procedures and methodologies is essential to maintain high safety and operational standards.

The piloting logic of the two aircraft is very different: on the Harrier, the pilot keeps his hands on the controls in a very high gain pilot-in-the-loop posture from take-off to landing. On the other hand, the F-35 automates the short take-off and vertical landing phases much more.

For example, to land on the carrier, the pilot simply positions himself on the downwind side, lowers the landing gear, and commands the transition to STOVL. The F-35 will then manage the entire transition sequence from horizontal to vertical flight under pilot demand of flight path and speed. It manages the power itself according to its weight and can also control its precise deceleration to speed according to that of the ship on which it is aligned. Then, when the aircraft flies along the edge of the ship, the pilot can finesse the spot on which he will land while controlling the translation with the trim or the stick. and the aircraft will come to rest on its own vertically above the chosen spot, remaining stable, regardless of the ship's movements. It will then give the best descent rate as soon as the pilot has indicated that he wants to land. After touching the deck, the aircraft reduces power on its own and moves to safety.

Dual type rating

"This dual type rating is a very strong asset for both communities, who can train together much more effectively by having a detailed understanding of the capabilities of both aircraft," added Molteni. "However, we haven't forgotten the young Harrier pilots: if they can't access this dual rating, we've given them the security clearance to participate in F-35 briefings and discover the aircraft's capabilities waiting for their time to transition."

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An Italian Navy F-35B and French Navy Rafale M fly over an idyllic-looking Brittany *Anthony Pecci*

In the absence of any two-seater F-35, training on the Lockheed Martin aircraft is a different story. The AM pilots begin their training on the F-35A in the United States before transferring to the F-35B. For the Navy's F-35B pilots, the situation is very different as they don't have the opportunity to train on the F-35A first. Since 2023, the Italian Navy and Italian Air Force has put together an internal training organisation. The initial part of the training is carried out with students and simulators located in Amendola Air Base; then, when the time comes, the qualifying pilot flies alone in an F-35. Most of the flights are made internally with GRUPAER jets and instructors. Currently, only a small number of F-35B pilots are trained every year although through-put is expected to grow in the future when a new simulator and academic facility will be available in the Italian Navy F-35B base in Grottaglie. **afm**

Options for change

On the eve of the Future Air Force Conference in Prague, held on September 17-18, Alan Warnes talked to Major Gen (ret) **Bohuslav Dvořák**, former Deputy Chief of the General Staff of the Czech Armed Forces, about the future of military flying training

CLV
0103
CLV

In Czech Republic, state enterprise CLV at Pardubice is training pilots for the CzAF and has been selected as a training site by the NFTE. The L-39Cs are now being replaced by the L-39NG Skyfox *Alan Warnes*

In Europe many air forces need to seriously consider their training capabilities and future requirements. Several NATO air forces fly dated training aircraft or helicopters, and with increasing operational demands, there needs to be a cost-effective and more coherent approach.

With the new fifth-generation Lockheed Martin F-35 Lightning II fighter, taking up more of an air force's budget, new solutions are being sought. Different approaches to take more of the flying training off the costly F-35 is everyone's ambition. For the Czech Air Force, it is a must.

In Europe, there are several routes to that ambition. Leonardo, in partnership with the Italian Air Force, has launched the International Flight Training School (IFTS) in Italy (see page 10-11) where air forces can buy training slots for Phase 2 basic training (on T 339CD/T-345), Phase 3 advanced training (on T 339CD/T-345), and Phase 4 Lead In fighter Training on T-346. Another option could be the Babcock International Group route, which secured a 17-year contract to provide support and training with the Pilatus PC-21 to both the French Air and Space Force and French Navy.

Or there is the Royal Air Force way, which works with Ascent Flight Training to deliver military fixed and rotary wing aircrew for frontline missions – although there are serious issues with the Hawk T2 advanced jet trainer. This has resulted RAF students being sent down other training routes like IFTS, and the Royal Australian Air Force (RAAF), while several European air forces use the European Joint Jet Pilot Training Program (ENJJPT) at Sheppard AFB, Texas. The list includes Belgium, Canada, Denmark, Germany, Greece, Italy the Netherlands, Norway, Portugal, Romania, Spain, Turkey and UK. However, Europe wants them to train in Europe.

On the horizon is the new NATO Flying Training in Europe (NFTE), a multinational initiative designed to create a network of training syllabuses across Europe for fighter, transport, helicopter and unmanned aircraft personnel. The goal is to ensure cost-effective and interoperable pilot training using existing facilities where possible, with the potential to expand or create new training capacity, and reduce reliance on facilities in the US.

In the Czech Republic, LOM Praha's CLV flight training centre offers this service, from screening up to advanced flying training. The 16 nations using it are Belgium, Canada,

The Leonardo T-346 fulfils a LIFT role, serving the International Flight Training School (IFTS) at Deci, Sardinia. With a shortage of training slots in Europe the IFTS is proving very popular Alan Warnes

Major General (ret) Bohuslav Dvořák is a former Mi-24 Hind pilot who retired as Deputy Chief of the General Staff of the Czech Armed Forces Major General (ret) Dvořák

By the end of August, four L-39NG Skyfox had been delivered to CLV to replace the veteran L-39C, and flying training is now underway. Alan Warnes

Czech Republic, Denmark, Germany, Greece, Hungary, Italy, Montenegro, Norway, North Macedonia, Poland, Romania, Spain, Turkey and the UK. Portugal is the only air force using ENJJPT that hasn't signed up to NFTE.

Major Gen (ret) Bohuslav Dvořák explained: "The UK has led the way in revolutionising the way air forces do their flying training. Outsourcing the business through a private finance initiative is what we in the Czech Air Force [CzAF] studied in the early 2000s, and then went on to take that route in the Czech Republic. State-owned LOM Praha's Flight Training Centre (CLV), was established at Pardubice in 2004, to carry out the CzAF flying training."

Due to delays in the UK's plans, the UK Military Flying Training System (MFTS) wasn't launched until 2008, four years after CLV commenced training.

"I am a big advocate of multinational co-operation in this area," Dvořák said. "We rely on co-operating with our allies during NATO operations, and while we can fight side-by-side, it's not exactly integrated.

"If we can learn to train flying under one syllabus, I believe it would increase the training efficiency and capability. If you integrate the training with your allies, I have no doubt it would reach a higher level of co-operation.

"It doesn't mean that you train all the pilots in the same centre; there could be several places, as long as it meets the needs at the national level. The NFTE will set out a very high level of standards, where they will be able to co-operate, to understand each other, even get to know each other, because that's very important."

Dvořák continued: "I think that if you have a training centre like CLV, it's very important to have direct co-operation with other training centres in the likes of Italy, France or UK, to exchange information and set up regular seminars to discuss practices that, for example, have been discarded by some but not others.

"The exercises we hold together might even be more effective, when everyone is trained to the same level and communication throughout.

"While flying Mi-24 *Hind* helicopters in Afghanistan, the Czech Air Force learnt a lot from our UK colleagues who we worked with, because we prepared together before we went into ops. Now the Multinational Helicopter Training Centre (MHTC) [in Sintra, Portugal] does that."

At the MHTC multinational advanced tactical training is delivered on a recurring basis, aimed at increasing inter-operability and standardisation, harmonise common tactics, techniques and procedures (TTPs). This identifies lessons that have been learnt coming from different training and operational activities. Adding to that is the pooling and sharing of simulation facilities, instructors, knowledge, assets and training facilities and areas, with the costs and burden being shared.

Dvořák exclaimed: "This is the way we should work in the NFTE. It makes a lot of sense! NFTE would train at Phase 2, 3 and 4, and this is where I see harmonisation – the IFTS is a classic example of this. I know that sometimes it's difficult to orchestrate the syllabuses because each nation has their own TTPs. But we must.

"As we look further into the future of sixth-generation aircraft, we will need to prepare with our allies in a different way, compared to today, and flight training will get even more expensive. The bottom line is we need to keep the quality of training on one side and the cost effectiveness on the other.

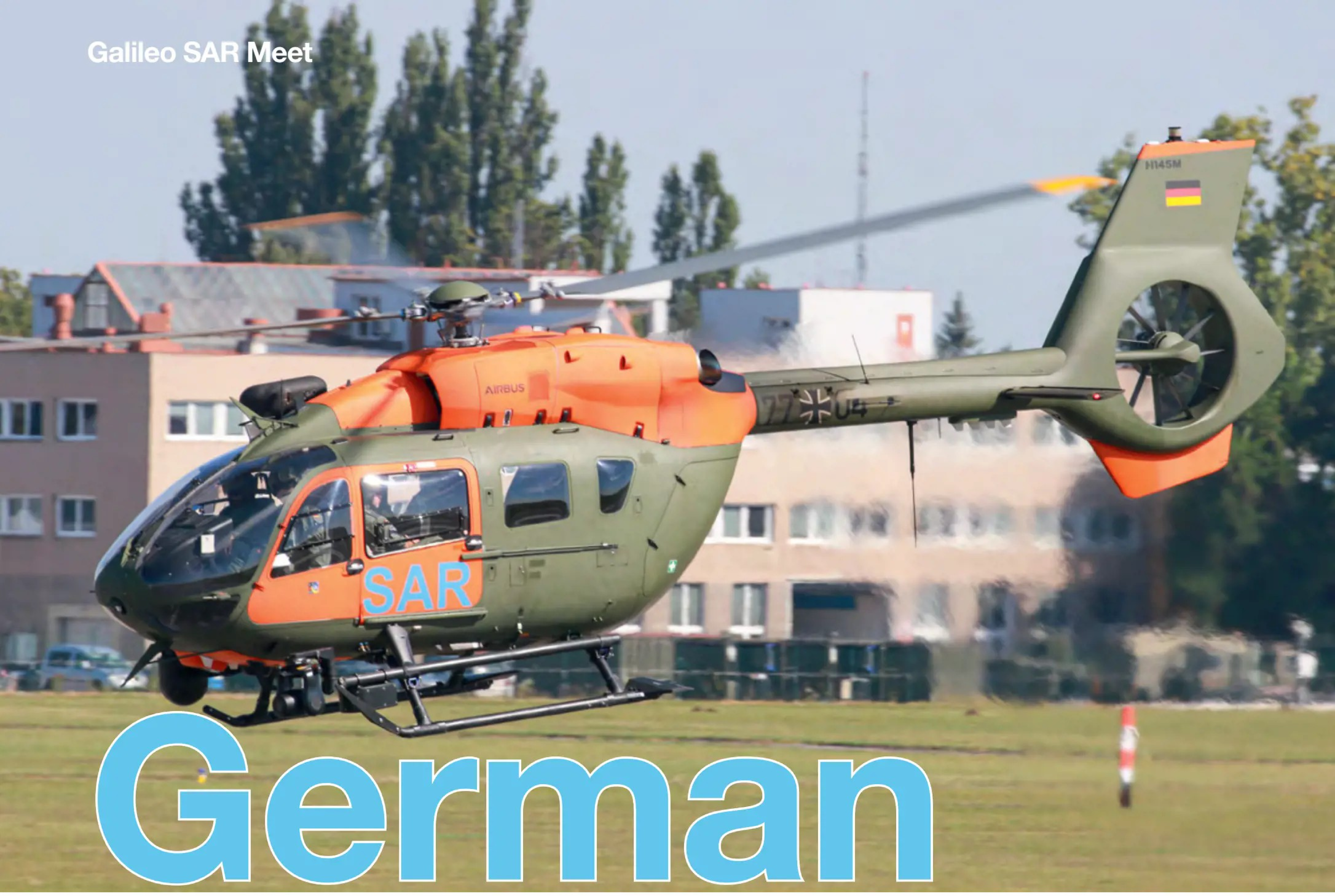
"Finding the right balance is what we are looking for. The quality at IFTS is very high and the T-346 is perfectly designed. The question, of course, is the operational cost. Do we need such an expensive operational aircraft or is it possible to do that in a more effective way?

"A turboprop could maybe fulfil the same role. For example, in France they fly the PC-21 and the newly winged pilots will go straight to a combat aircraft. In the Czech Republic, we are planning that newly trained L-39NG Skyfox pilots will transition to fifth-gen F-35As."

Lockheed Martin is collaborating to integrate the L-39NG Skyfox jet trainer into a comprehensive training system within CLV's Tactical Training Simulation Centre. The use of synthetics will be an integral part of flying training on the Skyfox transition to the F-35A's advanced systems.

Speaking as an advocate of the Czech aerospace industry, Dvořák added: "This vision is being built, so that the pilot can be trained on Skyfox in all phase 2/3/4s, including the use of artificial intelligence [VZLU Aerospace is focussing on this]. It's one for the future and not today."

The former Mi-24 Hind helicopter pilot finished by saying: "So for high quality training coupled with cost effectiveness, the Skyfox has to be a solution…" **afm**



German winners

Eleven helicopters took part in this year's Galileo SAR Meet 2025 at Kbely Air Base, on the outskirts of Prague in the Czech Republic, as **Alan Warnes** reports

Above: ***The overall winner of the enitre Galileo SAR Meet exercise was the crew of the H145 77+04 from the German Army's THR (Transporthubscrauberregiment) 30 at Niederstetten*** *All photos, author*

2025 Galileo SAR Meet Competitors

Country	Unit	Helicopter
Czech Republic	243 vrtulníková letka (Heli Sqn), 24 zDL Kbely	W-3A Sokol
	243 vrtulníková letka (Heli Sqn), 24 zDL, Kbely	Mi-17
	222 vrtulníková letka (Heli Sqn), 24 zDL, Namest	Mi-171Sh
	CLV, Pardubice	Mi-17
Belgium	40th Heli Sqn, Koksijde	NH-90NFH
Germany	MFG-5, Nordholz	Sea Lynx Mk88
	7 Staffel, THR 30, Niederstetten	H-145
Lithuania	Sraigtasparniu Eskadrile, 1 Aviacijos Baze, Siauliai	AS365N3+
Norway	330 Skvadron, 130 Luftwing, Stavanger-Sola	AW-101
Slovakia	vrtulníková letka, 51 Kridlio, Presov-Zokniai	UH-60M
Spain	803 Escuadron, Ala 48, Cuatro Vientos	NH-90TTH

RESCUE
0265

The Rescue Challenge discipline when the helicopter hovers before judges before putting down was won by the Royal Norwegian Air Force's AW101, the biggest helicopter to compete

The Czech Air Force's 22. základna vrtulníkového letectva (Helicopter squadron) at Náměšť nad Oslavou with its Mi-171Sh won the Ground Crew Challenge and the title of The Best Hoist Challenge

This Belgian Air Force navy-purposed NH-90NFH, RN-02 is one of four based with the 40 Squadron at Koksijde, though only two are currently mission-capable. This example and RN-03

Making a long trek from Cuatro Vientos in Spain was this Spanish Air Force 803 Escuadron NH-90TTH HD.29-17/10236 coded '803-17'. The unit, which operates six NH-90TTHs, had served as NATO's Special Operations Air Task Unit at Bezmer, Bulgaria, in February this year

With its imminent retirement, this German Navy Lynx Mk88 was probably making its last visit to the Czech Republic. Undoubtedly, the crew was hoping the helicopter would go out with a bang with a trophy, but it wasn't to be

With one of the crew looking out the open window this Slovak Air Force UH-60M has one of the shortest journeys home

The Lithuanian Air Force sent one of its three AS365N3+ to the drills - they provide SAR cover for Lithuania's waters

ROYAL DANISH AIR FORCE
FIRE & RESCUE
1
6

Down on the beach

The Danish Air Force recently led a multinational beach landing exercise on Rømø island off the southwest coast of Denmark. **Willem Sander Termorshuizen** and **Tieme Festner** (DAPPA) went to see the action

A Danish C-130J-30, emergency response crews, and beachgoers all share the shoreline as military and civilian worlds briefly converge during STOL operations on Rømø Beach *All photos, authors*

The Belgian Air Force's A400M, CT-03, arrives at Rømø Beach LZ to perform multiple STOL manoeuvres on the sandy strip

Bathed in early sunlight, Royal Danish Air Force C-130J-30, B-583, lands on Rømø Beach as part of the multinational STOL exercise

Luftwaffe KC-130J, 5504, kicks up a cloud of sand as it engages thrust reversers after landing on Rømø Beach, highlighting the challenges of operating on unprepared surfaces

In a striking display of tactical airlift capability, the Royal Danish Air Force (RDAF) led a rare multinational beach landing exercise on the island of Rømø, Denmark this summer.

Over the course of three days in August a coalition of NATO air forces carried out a series of landings and take-offs on the firm sands of Lakolk Beach, showcasing their ability to operate from austere, non-traditional runways.

Planning for the exercise began in the spring, with invitations sent out to allied nations. According to the RDAF mission manager, the entire operation was executed on a modest budget of just 500,000 Danish Krone (approximately €67,000). "We're hoping to expand the scope of the exercise in future editions, potentially incorporating wartime scenarios and even involving (special) forces for airborne insertions and tactical drops," the officer noted.

Belgian Air Force A400M passes the J-TAC and observers' enclosure near the outer runway designated for A400 operations at Rømø Beach

Conducted under NATO's Agile Combat Employment (ACE) concept, the exercise focused on dispersed operations and survivability in contested or degraded environments. The main objective: to test and validate Short Take-Off and Landing (STOL) procedures on unprepared surfaces – conditions often encountered during humanitarian relief efforts, Arctic missions, or forward resupply operations.

This marked the first time in two years that such a broad coalition of allied tactical airlifters conducted beach landings in Denmark. The 2024 edition was cancelled due to poor weather conditions that left the beach waterlogged and unsuitable for operations.

Each aircraft was assigned a minimum 30-minute slot to perform multiple landings, maximising training value. When one aircraft had to cancel, other aircrews quickly took the opportunity to extend their sortie times. In some cases, crews were swapped mid-mission while aircraft held in patterns over the sea, allowing each nation to make the most of its allocated time. On a typical day, more than 50 landings and take-offs were recorded.

Joint Terminal Attack Controllers (J-TACs) were deployed on the beach to manage aircraft movements and ensure safety during simulated tactical scenarios. These ground-based specialists played a critical role in maintaining communication between the flight crews and the improvised landing zone. In addition to Danish J-TACs, observers and J-TAC teams from several NATO nations (including France and the Netherlands) were present, underscoring the multinational interest in developing expeditionary capabilities.

Airspace deconfliction and traffic control over the Rømø peninsula were handled by Skrydstrup Air Traffic Control (ATC), ensuring the safe co-ordination of military and civilian airspace and the efficient sequencing of arrivals and departures.

Preparing the beach for flight operations required detailed groundwork. One day prior to the exercise, RDAF engineers probed the sand up to one metre deep to assess its load-bearing capability. Once deemed safe and compact, two improvised runways were marked out using orange indicators. The A400Ms operated from the runway closer to the shoreline, while C-130s used the strip located near the dunes.

The realism and complexity of the exercise highlighted its operational relevance. The ability to operate from beaches, highways, or other semi-prepared surfaces significantly enhances the flexibility and survivability of NATO's tactical airlift assets particularly in

Participating air forces

Denmark: C-130J-30 Super Hercules

Norway: C-130J Super Hercules

Sweden: C-130H Hercules (TP 84)

Germany (Luftwaffe): KC-130J Super Hercules & Airbus A400M

Belgium: Airbus A400M

Royal Danish Air Force C-130J-30 B-583, sporting a special 50 years tail badge of Eskadrille 721 from Aalborg, kicks up a cloud of sand as it takes off from Rømø Beach

Belgian Air Force A400M CT-03 touches down on the outer runway at Rømø Beach and kicking up a dust cloud of sand. Aircraft had to land between markers spaced 500ft apart, otherwise, a go-around was mandatory

Belgian Air Force A400M CT-03 is just airborne from Rømø Beach, demonstrating a short take-off and steep climb as part of the multinational STOL exercise

scenarios where conventional runways are unavailable or compromised.

For Denmark, the exercise aligns with its broader strategic emphasis on military mobility in the High North and Arctic regions. The participation of Belgium, Sweden, Norway, and Germany – as well as the presence of observers from France and the Netherlands – reflects a growing spirit of regional co-operation in the face of shifting security dynamics in Europe.

Though conducted as a training event, the Rømø beach landing exercise offered a realistic glimpse into NATO's evolving expeditionary posture. With six nations, multiple aircraft types, J-TACs in the field, and a single strip of sand, the exercise clearly demonstrated that tactical air mobility remains a cornerstone of modern European defence planning.

As global tensions rise and the need for rapid deployment capabilities increases, exercises like these may no longer be the exception but the new norm. afm

Luftwaffe A400M 5441 lifts off from Rømø Beach LZ during the exercise. The aircraft belongs to Lufttransportgeschwader 62 (LTG 62), based at Wunstorf Air Base

Luftwaffe KC-130J 5504 touches down on the 1,200m runway designated for C-130 operations at Rømø Beach LZ

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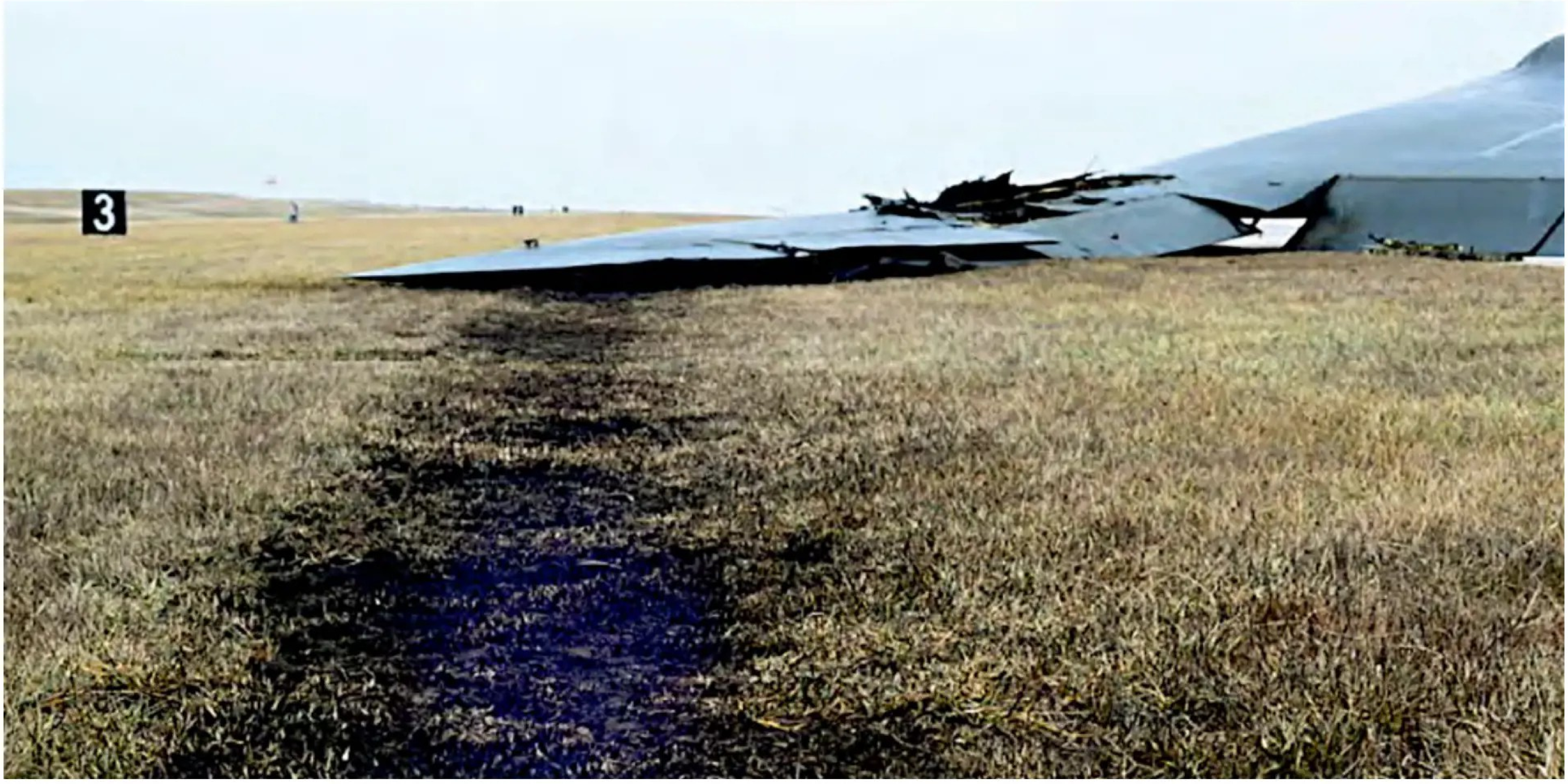
USAF B-2A Spirit accident report published



USAF B-2A Spirit 90-0041 'WM'/Spirit of Hawaii following its accident at Whiteman AFB on December 10, 2022, showing the damage to the left wing caused by the fuel tanks exploding *USAF*

A REPORT detailing the results of the USAF Aircraft Accident Investigation into a mishap involving a B-2A Spirit at Whiteman Air Force Base, Missouri, on December 10, 2022, (see *Attrition*, February 2023 and September 2024) was published on August 5 by Air Force Global Strike Command. The report identifies the aircraft involved as 90-0041 'WM'/*Spirit of Hawaii*, not 82-1068 'WM'/*Spirit of New York* as previously reported.

On December 10, 2022, at approximately 1429hrs Central Standard Time (CST), mishap aircraft (MA) B-2A Spirit tail number 90-0041 'WM'/*Spirit of Hawaii*, callsign 'Death 12' and assigned to the 509th Bomb Wing, 393rd Bomb Squadron, experienced a landing gear failure.

Earlier that day, at approximately 0700hrs CST, the MA launched from Whiteman Air Force Base (AFB), Missouri, as an airborne spare on a mission to Joint Base Pearl Harbor-Hickam (JBPHH), Hawaii. The mishap sortie (MS) was scheduled as a daytime, two-ship formation, aircraft commander upgrade training sortie and the primary mission for the formation was to fly one aircraft to JBPHH. The MA was an airborne back-up to ensure primary mission completion. The planned mission profile included a formation departure, simulated weapons activity and aerial refuelling prior to a formation break-up. After the formation break-up, if the MA was not required to assume the primary mission, then the MC would return to Whiteman AFB for an approach and landing.

The mission planning, maintenance, aircraft servicing, maintenance preflight inspections, aircrew preflight inspections, engine start, taxi and take-off were uneventful. Upon arriving at the en route decision point, the MA was directed to return to Whiteman AFB as planned. Similarly, the MA's return to Whiteman AFB was uneventful, until the approach to landing on Runway 01 (RWY 01). On the final approach, the mishap crew (MC) extended the landing gear at roughly 200 KCAS (within limits) and received a primary hydraulic system caution, followed by a back-up hydraulic system caution, indicating the system had begun to leak.

During the sequence to extend the landing gear, the left main landing gear (LMLG) and nose landing gear (NLG) extended fully. However, the right main landing gear (RMLG) did not extend. The MC then performed a successful emergency gear extension, which resulted in all three landing gears (LMLG, RMLG and NLG) indicating 'down and locked'. The MA was then cleared to land.

Touchdown occurred near the 1,000ft markers at about 1429hrs. Immediately upon touchdown, the LMLG collapsed. Approximately 7,000ft down the runway, the left wingtip and left rudder assembly began dragging through the unprepared surface west of RWY 01. Approximately 8,750ft down the runway, the left wingtip and rudder assembly were dragged across taxiway Bravo. The concrete surface of the taxiway eroded the left wingtip to such a degree that the fuel tank within the wing ruptured and caused a fire to ignite. As the MA continued down the runway, the left wing was dragged several thousand feet, rupturing the left fuel surge tank under the wing and causing a fire that spread to the left outboard fuel tank. The B-2A came to a stop 9,062ft down the runway, with the left wing extended into the grass infield and the fuel in the left surge tank feeding a left-wing fire.

The MC safely egressed the MA. Firefighters battled the fire as the left fuel surge tank and then the left outboard fuel tank exploded, destroying the left wing. The emergency terminated at 2051hrs CST. There were no injuries. The MA incurred an estimated $300 million in damage to the LMLG and outer left wing. There was approximately $27,500 in damage to the airfield.

The Accident Investigation Board (AIB) noted that the engineering parameters at landing (speed, attitude and recorded loads) did not indicate a hard landing, focusing attention instead on the landing-gear system behaviour following the prior emergency extension. The AIB found by a preponderance of evidence that the mishap was caused by a truck position sequence valve hydraulic CryoFit coupling failure. Additionally, the AIB found two substantially contributing factors: (1) MLG design vulnerabilities caused the lock link assembly to move out of the required over-centre (locked) position during an emergency gear extension; (2) the delay in using aqueous film forming foam (AFFF) to quickly extinguish the fire allowed the flames to spread, causing more external damage.

Following the incident, AFGSC temporarily suspended B-2A flights to inspect the fleet. During this pause, AFGSC maintained the ability to deploy B-2As for nuclear deterrence and long-range strike missions if needed. Full flight operations resumed on May 22, 2023.

Accident Reports

Hellenic Air Force/355 MTM CL-215-1A10 1067 being recovered after its incident on July 25 *Hellenic Coast Guard*

D: Sep 30, 1989
N: US Army/14th Medical Brigade
T: UH-60A Black Hawk
S: 84-23987

Updating our previous reports on the crash of this helicopter (see *Attrition*, January 1990 and July 2001), the unit operating it at the time was as given above. While returning from a medevac mission on the Atlantic side of the Panama Canal, the Black Hawk was on the downwind leg approaching over water for a landing at Howard Air Force Base when tail rotor thrust was lost. It spun and crashed into nine feet of water in Panama Bay approximately ¼ mile (400m) off Kobbe Beach. The accident investigation determined that tail rotor thrust was lost due to failure of a viscous bearing in the XSMN oil cooler on the tail rotor driveshaft. In addition to the previously reported fatality (medical officer SSG Adrian Rosado), all three of the other crew members were injured.

D: Apr 27, 2023
N: US Army/1st Attack Battalion, 25th Aviation Regiment
T: 2 x AH-64D Apache
S: 09-05564 and 09-05608

An accident we didn't report at the time. After a training sortie from Fort Wainwright, Alaska, to the Donnelly Training Area, these two helicopters were in a flight of 14 returning to base. During a planned turn to starboard into a mountain pass, approximately 48 minutes into the flight, they began to decelerate and then collided 30 seconds later at 1339hrs local time at about 71kts and 250ft above ground level, about 80 miles southwest of Fort Wainwright. Both were destroyed, killing both crew members in one and one in the other; the survivor was seriously injured. The fatalities were CW3 Christopher R Eramo, CW2 Kyle D McKenna and WO1 Stewart D Wayment.

D: Feb 23, 2024
N: US Army/Mississippi Army National Guard
T: AH-64D Apache

Another accident unreported at the time was the loss of this helicopter on a routine training flight when it crashed at approximately 1400hrs in a wooded area off Highway 30 near Mount Olive Baptist Church, near Booneville, Mississippi. The two crew members were killed: AH-64 Delta Apache standardisation instructor pilot Chief Warrant Officer 4 Bryan Andrew Zemek, assigned to Alpha Company, 1st Battalion, 149th Aviation Regiment, and maintenance test pilot Chief Warrant Officer 4 Derek Joshua Abbott, assigned to Delta Company, 2nd Battalion, 151st Lakota Medical Evacuation Unit.

D: Apr 30, 2025
N: US Marine Corps
T: F-35B Lightning II

The aircraft experience an engine fire on the ground at Marine Corps Air Station Iwakuni, Japan, during maintenance. One person sustained minor injuries, but the incident was classified by Naval Safety Command as a Class A mishap, indicating more than $2.5 million of damage.

D: Jun 5
N: US Navy
T: F/A-18E Super Hornet

During take-off from Naval Air Station Oceana, Virginia, the aircraft experienced engine flameout. Although it landed safely and without injury to the aircrew, Naval Safety Command has classified the incident as a Class A mishap, indicating more than $2,5 million of damage.

D: Jun 14
N: Royal Air Force
T: F-35B Lightning II
S: ZM168 '034'

Updating our previous report on this aircraft's emergency diversion to Thiruvananthapuram International Airport, India (see *Attrition*, August 2025), on July 7 an RAF A400M Atlas C1 arrived at Thiruvananthapuram bringing in a team of engineers, along with tools and spares. The stranded F-35B was then towed into a hangar. After a team of 14 engineers completed work to repair hydraulic and auxiliary power systems, it departed on July 22, heading to Darwin, Australia, to rejoin other F-35Bs on the Royal Navy carrier HMS *Prince of Wales* (R09). The repair team were due to be picked up by an RAF aircraft the following day to return to the UK.

D: Jun 17
N: Japan Air Self-Defense Force/601st Hikotai
T: E-2D Advanced Hawkeye

During a sortie from Misawa Air Base, the aircraft experienced an inflight hydraulic problem at 1110hrs local time and returned to the base, where a safe emergency landing was made at 1133hrs. No injuries were reported and damage to the aircraft was said to be minor, but the incident closed the runway until around 1230hrs, delaying two commercial flights.

D: Jul 25
N: Hellenic Air Force/355 MTM
T: Canadair CL-215-1A10
S: 1067

After scooping water in the Gulf of Corinth, near Vrachati, at 1040hrs local time during a firefighting mission from Elefsis Air Base to extinguish a blaze in Feneos, Corinth, the port engine failed and the aircraft was unable to take off again. The pilots were unhurt and the aircraft, which sustained only minor damage, was towed to the shore at Kiato by a small boat. It was then lifted onto the shore by crane to await examination and repair.

Blazing wreckage of a US Navy/VFA-125 F-35C Lightning II near NAS Lemoore on July 30 *Fresno County Sheriff's Office*

Attrition Report

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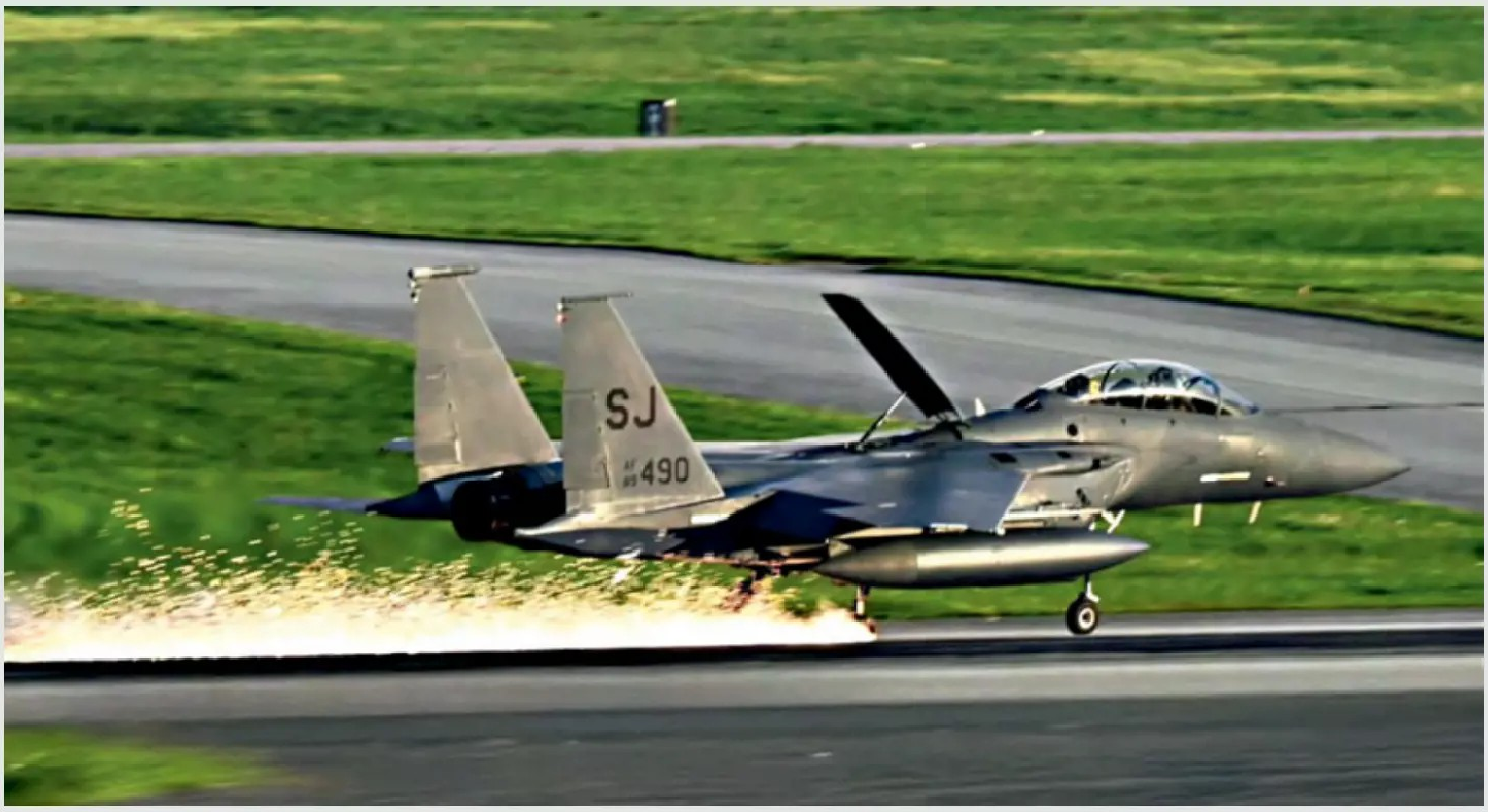


USAF 336th FS F-15E Strike Eagle 89-0490 'SJ' creates a shower of sparks as it lands at Kadena Air Base, Japan, with a missing starboard mainwheel on August 4 Via Twitter

D: Jul 30
N: Brazilian Air Force/Academia da Força Aérea/Esquadrliha da Fumaca (Smoke Squadron)
T: A-29A Super Tucano
S: FAB5724

Updating the previous report (see *Attrition,* September 2025), the serial of the A-29A which crashed was as given above, not 'FAB5721'.

D: Jul 30
N: US Navy/VFA-125
T: F-35C Lightning II

This aircraft was destroyed when it crashed and caught fire at approximately 1835hrs local time in a cotton field, just north of Naval Air Station Lemoore/Reeves Field, Fresno County, California. The pilot ejected safely, but the crash ignited a ground fire which spread over five acres but was fully extinguished just before 2300hrs.

D: Aug 4
N: Russian Air Force
T: Su-30SM

During a Ukrainian Security Service (SBU) drone attack on Saky Air Base, Novofedorivka, Crimea, this aircraft was destroyed while parked on the ground. Another Su-30SM and three Su-24s were damaged during the attack.

D: Aug 4
N: US Air Force/4th FW/336th FS
T: F-15E Strike Eagle
S: 89-0490 'SJ'

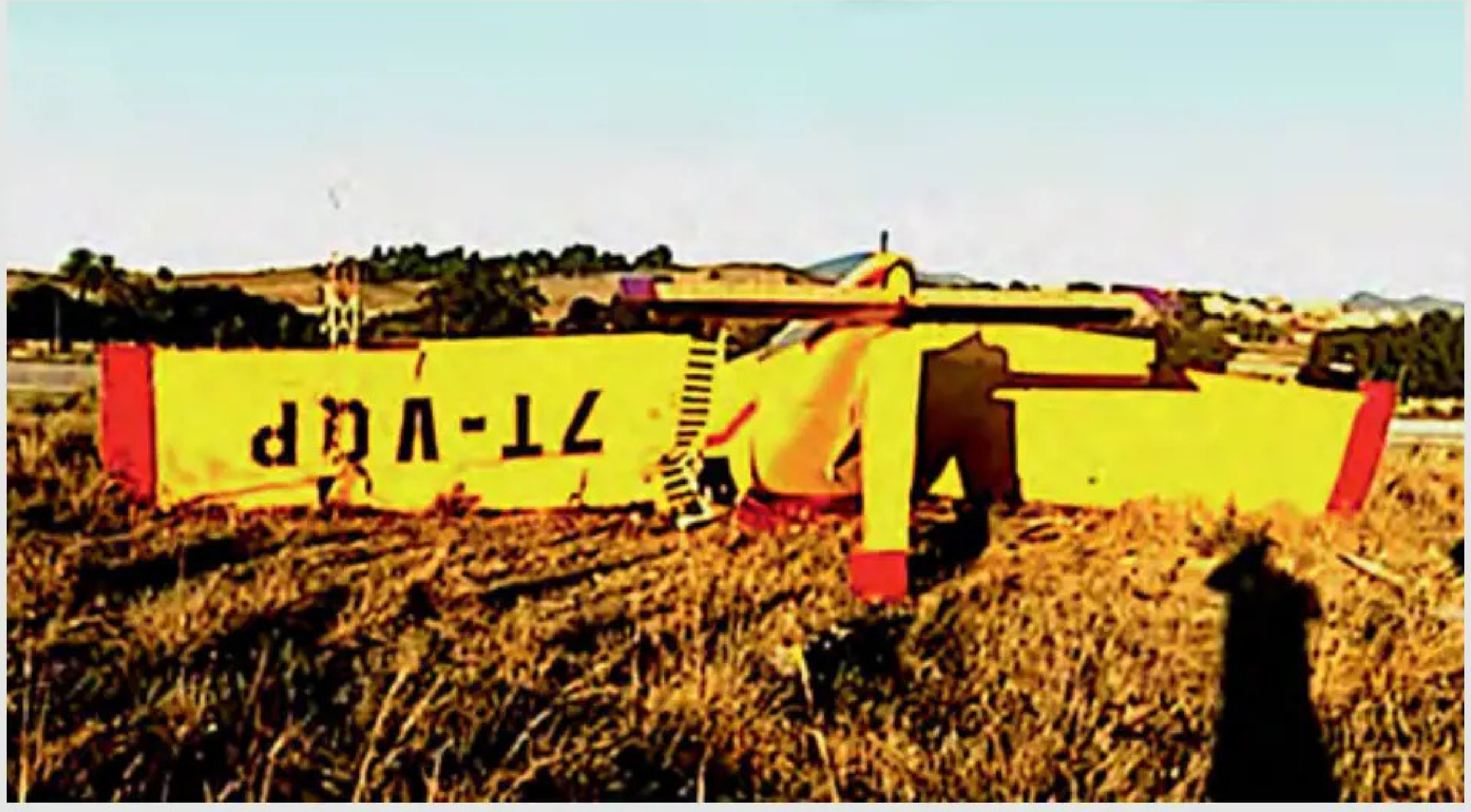
While deployed from Seymour Johnson Air Force Base, South Carolina, the aircraft made an emergency landing at 1840hrs local time on runway 23R at Kadena Air Base, Japan, with a missing starboard mainwheel. The two crew were unhurt and the aircraft sustained only minor damage. The missing wheel was later located and recovered from the flight line at Naval Support Facility Diego Garcia, British Indian Ocean Territory, from which the F-15E had departed earlier. Following the incident, the 18th FW conducted safety inspections of all of the 336th FS F-15Es detached to Kadena.

D: Aug 5
N: Protection Civile Algerienne
T: ECA Safir-43
S: 7T-VQP

The aircraft was destroyed when it crashed on take-off for a training flight from Jijel-Ferhat Abbas Airport, Taher. All four occupants were killed. The Safir-43 is a Zlin Z-43 built under licence by Etablissement de Construction Aéronautique (ECA) in Algeria.

D: Aug 6
N: Ghanaian Air Force/3 Squadron
T: Harbin Z-9EH Haitun
S: GHF 631

After departing from its base at Accra Kotoka International Airport at 0912hrs local time for Obuasi Airport the helicopter was destroyed when it crashed and caught fire at 0920hrs into a forested mountainside near Adansi Akrofuom in Ghana's Ashanti Region. The three crew members and all five passengers were killed, including Ghana's Minister of Defence, Dr Edward Kofi Omane Boamah, and Minister of the Environment, Science and Technology, Alhaji Dr Ibrahim Murtala Mohammed, plus Alhaji Muniru Mohammed Limuna, acting Deputy National Security Co-ordinator and former Minister of Food and Agriculture, Samuel Sarpong, vice chairman of the National Democratic Congress (NDC), and Mr Samuel Aboagye, a former parliamentary candidate. The crew were Squadron Leader Peter Bafemi Anala, Flying Officer Amaning Twum Ampadu and Sergeant Ernest Addo Mensah. They were on their way to talks about methods of tackling illegal mining.



Wrecked Protection Civile Algerienne Safir-43 7T-VQP that crashed on take-off from Jijel-Ferhat Abbas Airport on August 5 PCA

D: Aug 7
N: Japan Air Self-Defense Force/3 Hikotai
T: Mitsubishi F-2A

While on a training exercise with three F-2s and two U-125As, this aircraft was destroyed when it crashed at approximately 0035hrs local time into the Pacific Ocean off the coast of Ibaraki Prefecture. The pilot ejected safely and was rescued by a UH-60J helicopter. The aircraft had taken off from its base at Hyakuri at 1145hrs but when some 150km northeast of the base, the pilot reported a problem. As a precaution, the JASDF grounded all 90 of its F-2s unless required for critical missions. Part of the fuselage was later found at the crash site.

D: Aug 10
N: Royal Air Force
T: F-35B Lightning II
S: ZM150 '016'

This aircraft, from the Royal Navy aircraft carrier HMS *Prince of Wales* (R09), had been in South Korea and was participating in a joint exercise with Japan Maritime Self-Defence Force and US forces when it encountered a technical problem while en route back to the ship. It made an emergency diversion to Kagoshima Airport, in Kirishima City, southwest Japan, where it made a safe precautionary landing at approximately 1130hrs local time. The pilot was unhurt, but the F-35B closed the runway for 20 minutes, delaying six commercial flights. It was still at the airport four days later, awaiting the arrival of repair parts.

D: Aug 12
N: Iraqi Army Aviation Command
T: EC635T2+

Following a technical malfunction on take-off, the helicopter made an emergency landing in a car park in the city of Karbala. As it touched down, the EC635 struck and damaged a vehicle, at the same time resulting in minor damage to the helicopter. No injuries were reported either to the crew or anyone on the ground. A video of the incident shows it spinning round rapidly and landing heavily, suggesting a possible tail rotor problem.

D: Aug 12
N: US Air Force/Massachusetts ANG /104th FW/131st FS
T: F-15D Eagle
S: 85-0134 'MA'

While taxiing after landing on runway 02 at Barnes Air National Guard Base, Westfield Barnes

Regional Airport, Massachusetts, the back-seater accidentally ejected after the aircraft, callsign 'Rambo 1', had turned onto taxiway B. The passenger was a recruiting officer from the 104th FW at Barnes who had been given an incentive flight. Although the parachute deployed successfully, it was not reported whether the officer sustained any injuries. Damage to the aircraft appeared to be minimal.

These smouldering remains were all that was left of Ghanaian Air Force Harbin Z-9EH Haitun GHF 631 after an incident on August 6 GAF

D: Aug 14

N: Russian Navy

T: Su-30SM

This aircraft was destroyed in a crash in the Black Sea near Zmiinyi (Snake) Island, Ukraine. A search for the two pilots proved unsuccessful and they are presumed dead.

D: Aug 14

N: Ukrainian Ministry of Defence/ Main Directorate of Intelligence

T: Aeroprakt A-22 *Foxbat* (modified)

This light aircraft, modified in an unmanned configuration, was destroyed when it crashed into a residential apartment building in Rostov-on-Don. Thirteen people on the ground were injured, two of them severely.

D: Aug 14

N: US Navy

T: P-8A Poseidon

The aircraft experienced an engine fire on the ground, which was safely extinguished without injury to personnel. The location was withheld, citing operational security considerations, but it has been categorised as a Class A incident by Naval Safety Command, indicating more than $2.5 million of damage.

D: Aug 15

N: Khyber Pakhtunkhwa (PK) Government

T: Mi-171E

S: AP-BIL

This helicopter was destroyed when it crashed near Pindiali, Mohmand, in Bajaur District, Khyber Pakhtunkhwa, Pakistan, while carrying relief supplies to the area, which had suffered major flooding. All five crew members on board were killed.

D: Aug 16

N: Kyrgyzstan Air Force/ Helicopter Regiment

T: Mi-8

S: 205

During a high-altitude mountain rescue operation in the area of Pobeda Peak, the helicopter was damaged in a hard landing at an altitude of 15,091ft in difficult weather conditions at approximately 0830hrs local time. Two of the ten people on board (the crew commander and a rescuer) sustained various fractures, but were reported in stable condition. The Mi-8 had been sent to evacuate one dead and two seriously injured climbers.

D: Aug 19

N: Royal Malaysian Air Force/ RMAF College/Flying Training Centre 1

T: Pilatus PC-7 Mk II

While being flown by a student on a solo flight, the aircraft was involved in an accident at No 2 Air Base Alor Satar-Sultan Abdul Halim Airport at 1130hrs local time. The pilot was uninjured, but damage to the aircraft was not reported. A distant image of the PC-7 showed that it appeared to be on its belly and blocking the runway, which was temporarily closed.

D: Aug 20

N: US Navy/VFA-83

T: F/A18E Super Hornet

At approximately 0935hrs EDT, the pilot ejected from this aircraft while operating off the coast of Virginia during a routine training flight. Multiple search and rescue assets were deployed and the pilot was rescued at approximately 1121hrs. The F/A-18E remains in the water where it crashed. The cause of the mishap is under investigation.

D: Aug 21

N: Policía Nacional de Colombia

T: UH-60 Black Hawk

This helicopter was destroyed when it was reportedly shot down in Los Toros, a rural area of Amalfi, Antioquia, by the 36th Front of the Estado Mayor Central, dissidents of the now disbanded former Revolutionary Armed Forces of Colombia (FARC) guerrilla group. The crash killed 13 of the 16 occupants and injured the others. The Black Hawk had arrived in the area to evacuate officers who had been attacked during ground spraying to eradicate illicit coca crops.

Wreckage of Khyber Pakhtunkhwa Government Mi-171E AP-BIL after its crash on August 15 KP Relief

D: Aug 21

N: Royal Malaysian Air Force/18 Skuadron

T: F/A-18D Hornet

S: M45-07

The aircraft was destroyed when it caught fire and crashed on take-off at 2105hrs at No 4 Air Base Kuantan/Sultan Ahmed Shah Airport. Both crew members ejected safely. The pilot, Major Mohamad Azhar Alang Kamarudin, sustained back injuries and suffered minor burns to his left heel, while the co-pilot, Weapons Systems Officer Captain Mohamad Izzuddin Mohamad Salleh, escaped with only bruises. The crash occurred at the beginning of a routine night-flying training exercise. After the crash, RMAF Hornet operations were temporarily suspended pending investigation. The aircraft would normally be based at No 6 Air Base Butterworth but 18 Skuadron had been temporarily deployed to Kuantan while the runway at Butterworth is upgraded.

D: Aug 22

N: US Marine Corps/3rd MAW/ MAG-16

T: CH-53E Super Stallion

The helicopter was damaged beyond repair after it caught fire on the ground at Marine Corps Air Ground Combat Center Twentynine Palms, California, at approximately 1310hrs PDT. All personnel on board were able to evacuate safely and the fire was extinguished by emergency responders.

D: Aug 23

N: Ukrainian Air Force/40th Tactical Aviation Brigade

T: MiG-29 *Fulcrum*

The aircraft was destroyed when it crashed during a night approach to an unspecified airfield after completing a combat mission. The pilot, Mayor Serhii Viktorovych Bondar, was killed.

Additional material from: Scramble/Dutch Aviation Society and Asagiri Yohko.

Next Issue

A French Air and Space Force Mirage 2000-5F from Escaderon de Chasse 1/2 'Cigognes', based at BA118 Luxeuil-Saint Sauveur, followed by a Royal Netherlands Air Force F-35A *Gérard Gaudin*

King in the castle

For two days in early August, the Florennes Air Base in Belgium hosted an international exercise which involved a dozen combat aircraft of four types belonging to three European air forces. **Gérard Gaudin** reports

- **New Italian Air force P.180s**
  The Scuola Addestramento Trasporti Aerei is the unit of the Italian Air Force destined to train pilots for multi-engine fleets. In 2025 they started to operate with the newest and most advanced Piaggio Aerospace P.180. Riccardo Niccoli investigates

- **Soaring high: Inside the Turkish Air Force's elite pilot training**
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NEXT ISSUE

The November edition of *AirForces Monthly* is on sale from October 16, 2025

Below left: ***One of the flight lines of the Italian Armed Forces P.180 fleet on the apron of the 14° Stormo in base at Pratica di Mare*** *Riccardo Niccoli*

Below right: ***Seen taking off is this Turkish Air Force T-38M from 121 Filo 'Arı' (Bee). This aircraft is the final step before the newly qualified pilots earn their wings***

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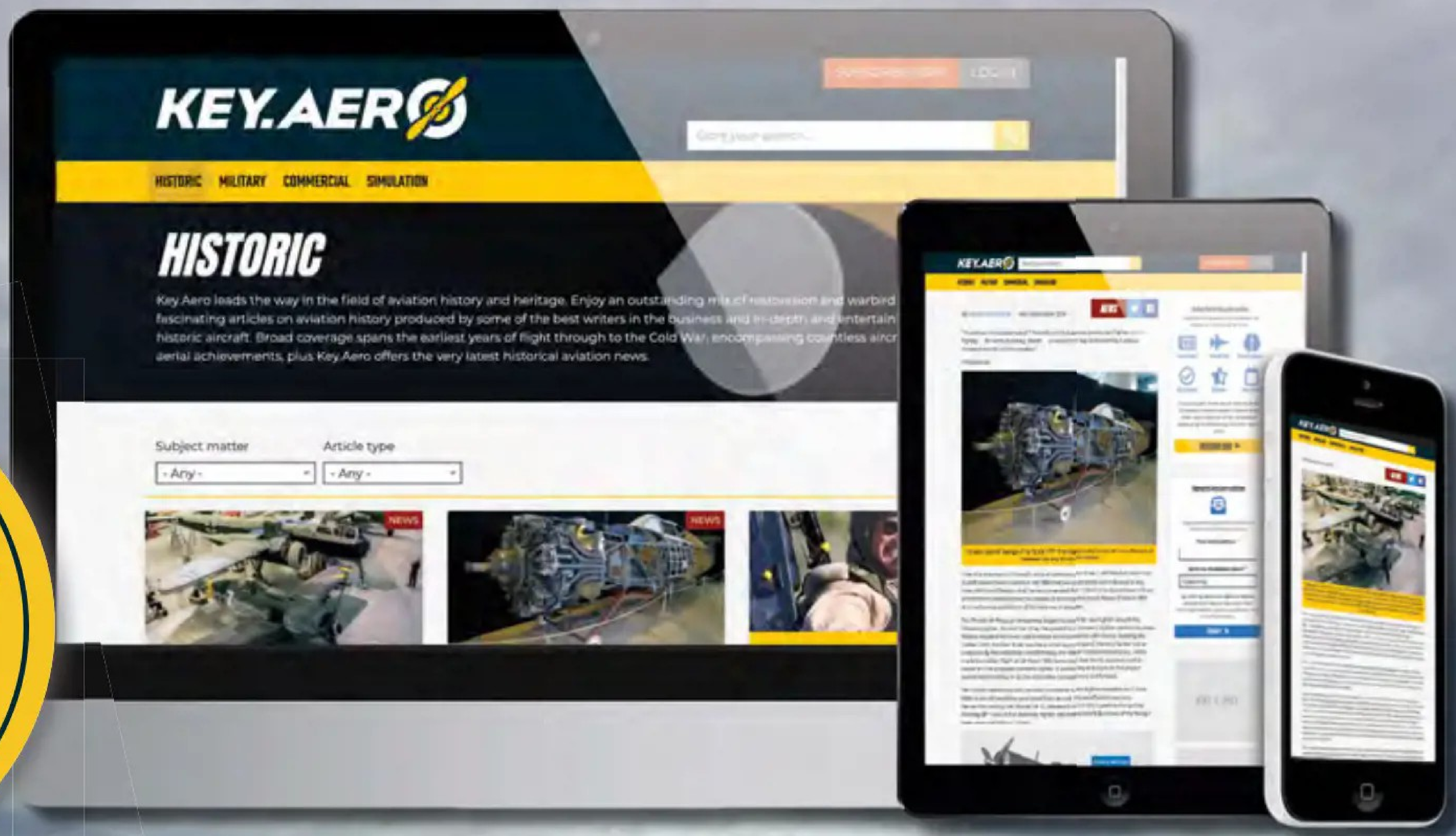
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